CONVENTION ISSUE, OCTOBER, 1921

VOLUME 7 NUMBER 10

An Appreciation and A Message

THE greatest things in the world have been accomplished through cooperation. Nowhere has its value been more thoroughly tested than by mining men, through their national organization, The American Mining Congress.

As President, I wish to express sincere appreciation for the assistance given me by the mining fraternity, and for the loyal support given the organization.

The year 1921 has been a dismal one for all branches of mining, but we now have turned the corner, and have every reason for the greatest optimism. Mining is fundamental to national prosperity, and it is my firm conviction that we are on the eve of the greatest era of prosperity this nation has ever known.

I bespeak for The American Mining Congress your continued loyal support, and through it, as the common factor, the working out of our mining problems, thus advertising to the world that the second greatest national industry can and will and does, Cooperate.

W. J. Rees

President.

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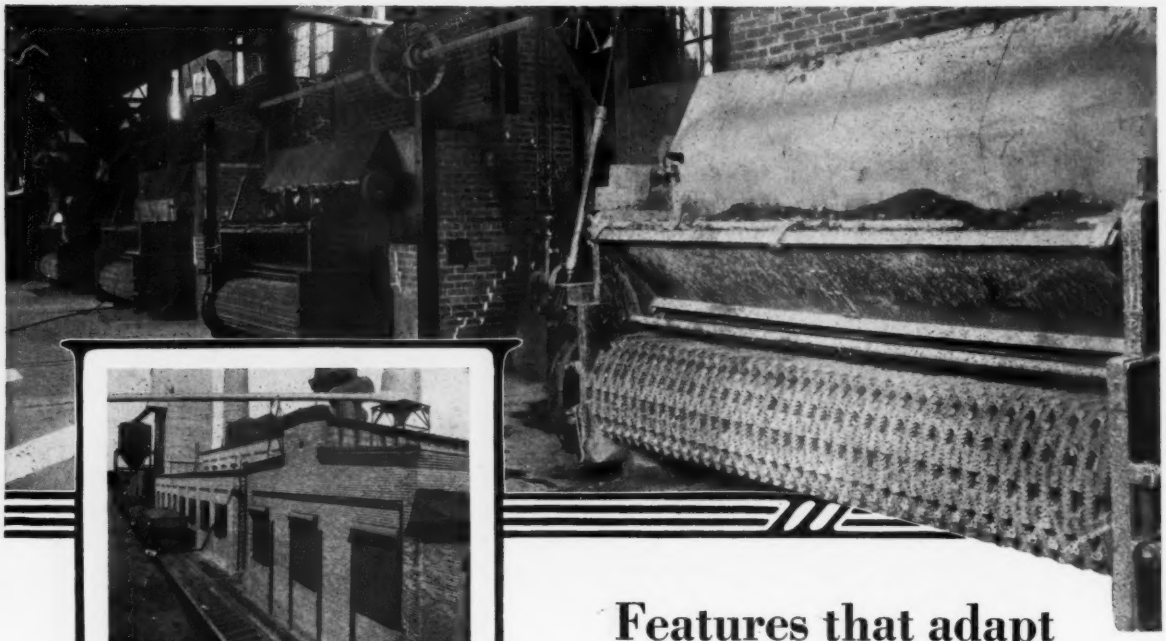
264 PAGES 84 ILLUSTRATIONS 60 NEWS AND FEATURE ARTICLES



Exterior of power plant Olds Motor Works, Lansing, Michigan. Above: interior.

At the Olds Motor Works—

four Illinois stokers (natural draft) installed under 500 hp. boilers are meeting the load demands of this rapidly growing plant.

"They respond readily to load fluctuations," said J. W. Bailey, Supt. of Power, "burn a much cheaper grade of coal than could be burned formerly, and do not form clinkers."

Then he summed up the record of the Illinois Stokers in his plant by stating: "We are in favor of Illinois Stokers because they are low in upkeep, require less man power, and form no clinkers."

The Olds plant is part of the General Motors Corporation.

Features that adapt the chain grate to all loads and coals

THE Illinois Stoker embodies the well established chain grate principle at its best. It adds to the basic advantages of the chain grate principle—

Dampered Air Control for High Efficiency

As illustrated opposite the draft can be regulated throughout the entire length of the grate surface and adjusted to insure complete combustion with all grades of bituminous coals at all loads.

And for Heavy Overloads; Forced Draft

The dampered air chambers under the grate surface permit the successful application of forced draft to the basically correct chain grate principle. The Illinois can be forced far beyond the limits of natural drafts.

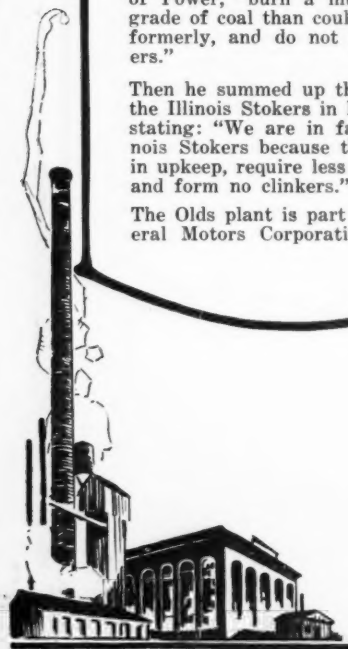
For Burning High-Volatile Lignite, Coke-Braise and Anthracite Culm; Mechanical Ignition

The sectional view shows how a tuyere operated under induced draft conditions draws heated gases through the incoming fuels and successfully ignites coals that formerly presented a baffling ignition problem.

Illinois Catalog L tells the story in detail

Your copy is ready

Illinois Stokers are made in two types: Type A natural draft and Type G forced draft with mechanical ignition, when necessary for burning high-moisture low-volatile coals



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ILLINOIS STOKERS

CHAIN GRATE — *With Dampered AIR CONTROL*

THE MINING CONGRESS JOURNAL

OCTOBER 1921

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WITH THE MINING CONGRESS AND ITS CHAPTERS

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The Copper and Brass Research Association

25 Broadway — New York City

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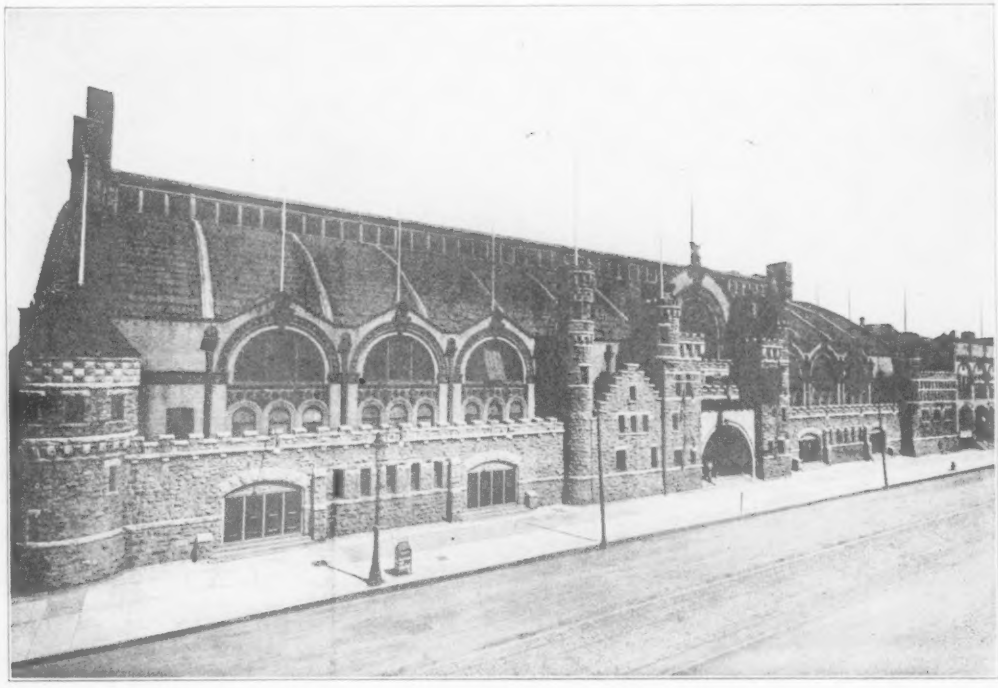
EXHIBITORS ····· SECTION

National Exposition
of
MINES AND MINING EQUIPMENT
Auspices
THE AMERICAN MINING CONGRESS
THE COLISEUM, CHICAGO, ILL.
OCTOBER 17 TO 22



The Coliseum—500,000 square feet of exhibit space where The National Exposition of Mines and Mining Equipment will be held, October 17-22, 1921

EDITORIAL

THE future industrial development of our country depends upon the utilization of our low-grade mineral deposits.

Without the wonderful development of our porphyry copper deposits, the result of the world war might have been different.

A comparison of early methods of mining and the methods employed today points out clearly what the manufacturer of mining machinery has been able to accomplish.

The advancement in methods of zinc mining has made possible its present day broad use in common necessities.

It has been stated that we have mineral reserves sufficient to last hundreds of years, but our high-grade deposits are rapidly being exhausted.

Cheap coal is an industrial necessity, and upon the machinery manufacturer largely depends the operator's ability to furnish it.

We must utilize our more expensively mined minerals and the manufacturer of mining machinery must produce equipment to enable its production, or the nation cannot advance.

The successful handling of low-grade iron deposits will insure life to our great steel industry.

The manufacturers of mining machinery have contributed greatly in the development of our low grade minerals and in this section we find the "Progressives" of the industry.

The recovery of gold from low-grade ore is essential to the maintenance of our Gold Standard.

THE AMERICAN MINING CONGRESS, as representing the whole Mining Industry, hereby pays its tribute to the great inventive genius of our manufacturers, and pledges its cooperation for the highest development and the most complete utilization of our mineral resources.

The above cut shows the Standard Myers-Whaley Machine which will be on exhibit at the American Mining Congress Exposition Chicago, Illinois, October 17-22, 1921

This Machine will be in operation on the Main Floor of the Coliseum, in Spaces 16 and 17

Our operator will demonstrate the flexibility of the machine and the ease with which the shovel is swung from side to side and the machine propelled. A good opportunity to observe the very interesting Whaley shovel motion will be afforded. This is the most effective and efficient automatic shoveling device that has ever been designed.

Myers-Whaley machines have been in use for 10 or 12 years in many different classes of work, including Coal, Iron Ore, Lead Ore, Copper Ore, Rock Salt, Limestone, Gypsum, Shale, Tunnel Mucking, etc. The machine on exhibit embodies the latest improvements made by the Myers-Whaley Company. It demonstrates the extent to which the Myers-Whaley Company has *Standardized* its machines. Every part of this machine is interchangeable with parts of other Myers-Whaley machines of the same size. It illustrates the type of construction which years of experience have taught to be essential in machines to meet the exacting and heavy duty of loading rock, ores, coal, etc, into mine cars.

Our representative will be on hand to answer all questions regarding the use of our machines, cost of upkeep, etc. If in the meantime information is desired regarding the use of our machines in your operation, please mention your conditions when writing for catalog and treatise, also data pertaining to similar operations.

MYERS-WHALEY COMPANY

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Hercules Booth at Denver Convention of The American Mining Congress. November 1920

And the National Exposition of Mines and Mining Equipment The Coliseum, Chicago, Ill. October 17th to 22nd inclusive, 1921

Coming to Chicago

Matters, vital to the welfare of everyone engaged in the mining industry, will be considered and acted upon at the Chicago Convention of the American Mining Congress.

In addition to important convention sessions, there will be held in the Coliseum, what promises to be the greatest exposition of mining machinery and materials ever assembled. The U. S. Bureau of Mines, individual states, foreign governments, and leading manufacturers of the country will have exhibits.

At the Denver Convention last year, blasting questions were discussed with many mining men who visited our exhibit. The results of some of these discussions we believe were mutually beneficial.

We anticipate similar opportunities at Chicago and cordially invite every delegate and visitor to visit the Hercules Booth—No. 31. Bring your blasting problems with you.

If you are not planning to attend this convention, write us at any time for information desired on blasting subjects. Naturally we've had considerable experience with the use of explosives in a great variety of work, and whatever we've learned is at your disposal.

Our book—"Hercules Products"—contains useful data on explosives, blasting supplies, and their uses. It's yours for the asking.

Hercules will be there Booth 31

HERCULES POWDER CO.

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San Francisco, Cal.
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Wilmington, Del.

The increasing necessity for maximum efficiency in all mining operations requires that every available method for improvement be applied

Dipper-trip panel, hoist panel, and crowd or swing panel used in control of the 300-ton electric shovel shown above.

Four-unit motor generator set consisting of a synchronous motor, exciter, and three direct current generators.

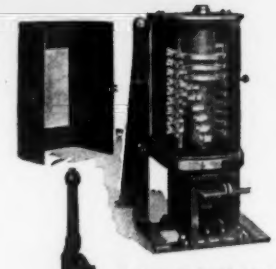
Bigger bites at less cost with the electric shovel

THE electric shovel has become an immense factor in mining and excavating. Coal veins too close to the surface for safe shafting, yet too deep for old-method open-cut mining are being stripped electrically with very profitable results. Open-cut limestone quarrying, once sluggish, now can keep pace with milling and loading. Bulk loading and big-scale digging can be done nearly twice as fast and at about half the old cost.

The 300-ton electric shovel, illustrated above, operates with greater power economy and fewer men—and cuts deeper over a wider radius than any predecessor.

All the electric equipment except the crowd motor on the boom, is located in the 50 x 22 foot cab. This equipment consists of one four-unit motor generator set with direct-connected exciter, two hoist motors geared to a common shaft, one swing, one crowd, and one dipper trip motor.

G-E engineers, experienced in design and manufacture of electric equipment for shovels, offer capable co-operation to manufacturers. Ask the nearest G-E office for further information.



Foot-operated master switch for controlling swing motor.

Hand-operated master switch for controlling the crowd or hoist motor.

General Electric Company

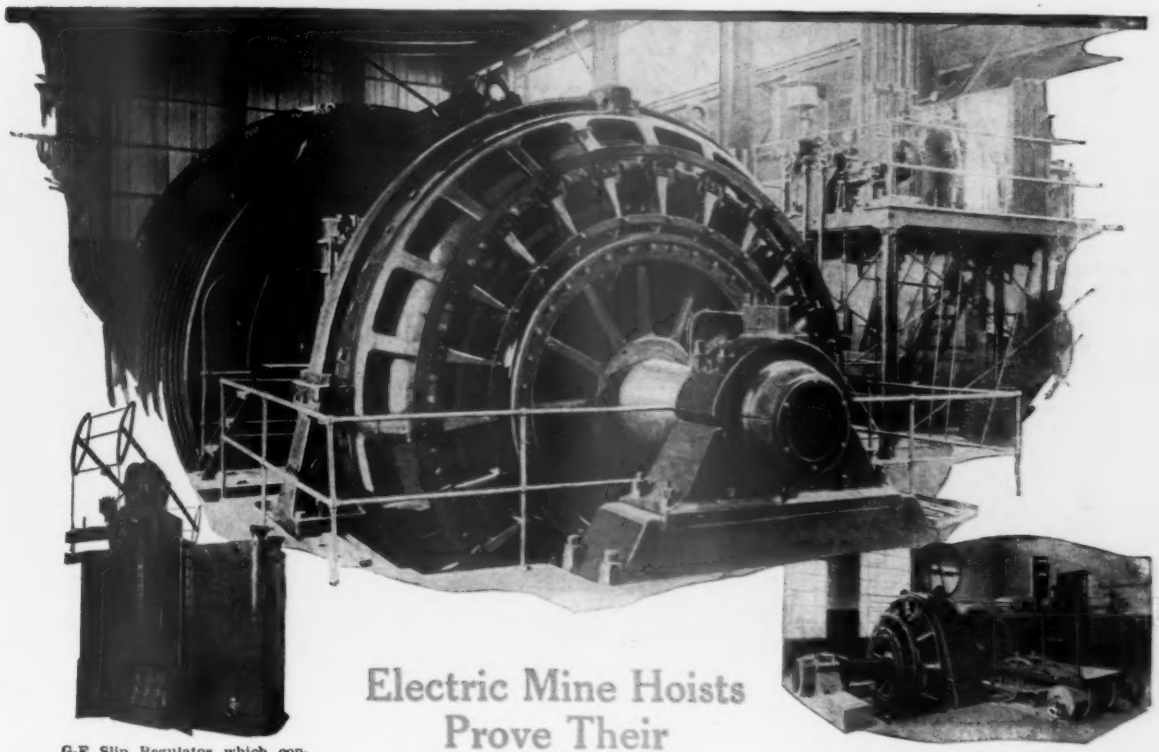
General Office Schenectady, N.Y.

Sales Offices in all large cities

43B-595

General Electric Company Headquarters at Convention
Space 120-121, Coliseum, Chicago

Proof of superiority by a succession of practical demonstrations is the true test of the value of a new method



G-E Slip Regulator which controls and holds constant the power input from the line when the Ilgner system of hoisting is used

G-E 1400 hp. Ilgner System Hoist equipment installed at Consolidation Coal Company's mine

Electric Mine Hoists Prove Their Predominance

In mines the steam hoist has lost its hold. Expert mining reports and accurate cost accounting prove conclusively the advantages of electricity not only for new installations but also for changing over from the old.

The General Electric Company has installed 162,000 H.P. of motor drive for mine hoists in units of 250 H.P. and larger that are now in operation. Featured above is a G-E 4000 H.P. motor equipment—the largest electric motor drive for hoists in the world, now serving in a South African mine—and the General Electric Company is now building one of 5000 H.P. for a neighboring mine.

The successful operation of these thousands of horsepower affords manifold proof of dependability and economy gained. G-E hoist motors and control are designed by engineers who have an intimate knowledge of mining conditions. The service of these engineers is at your command.

General Electric Company

General Office Schenectady, N.Y.

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General Electric Company Headquarters at Convention
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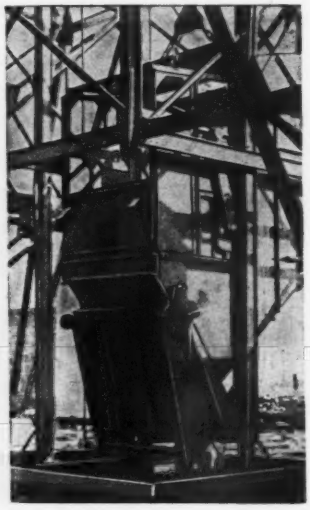
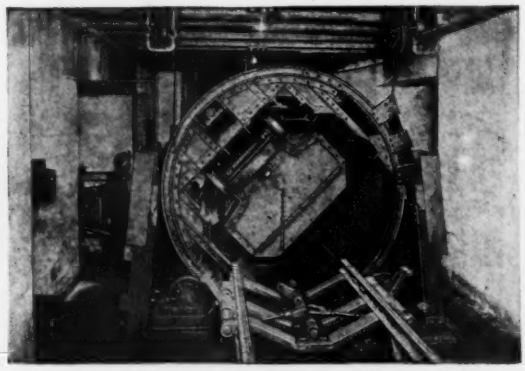
Solidcar Dumping at All Types of Mines



The "Solidcar" Self-Dumping Cage hoists any type of car and dumps it in your head frame
No Breakage No Lost Time for Dumping No Spillage
Lower Peak Loads on Hoist Smooth Dumping Operation
Greater Capacity. It Never Misses the Dump

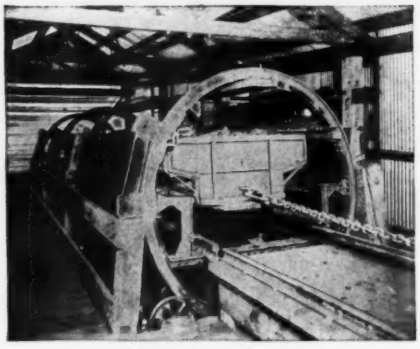


The Rotary Car-Dumper at Shaft Bottom and Skips.
Saves Power Greatest Capacity Saves Labor
No Uncoupling of Trips Less Breakage

At Drift Mines. Greater Capacity
Less Labor Less Breakage

At Incline Mines. No Labor or Dumping
Fast Handling of Trips
Trips Never Uncoupled From Ropes
Complete Trips Dumped At Once, or one car at a time
The life and strength of old cars may be increased by bolting up end gates
Solid-body cars are cheaper and stronger and have no gates or doors to keep in repair

SEND FOR BULLETIN GIVING ENGINEERING DATA CONCERNING APPLICATION TO YOUR TYPE OF OPERATION



At Slope Mines. No Labor for Dumping
Fast Handling of Trips
Trips Never Uncoupled from Rope
Complete Trips Dumped, or one car at a time

Rotary Car-Dumpers for Mine Cars (Gravity, Electric or Pneumatic Drive)
"Solidcar" Self-Dumping Cages
The Mechanical Spragger
Hydraulic Trip Control Equipment
Car Control and Caging Equipment
Rotary Car-Dumpers for Standard Gauge Railroad Cars
Safety Check Carrier for Mine Cars

SEE OUR EXHIBIT, SPACE 161, AT THE AMERICAN MINING CONGRESS CONVENTION, COLISEUM, CHICAGO, OCTOBER 17th-22nd

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2"x10"—No. 913A.

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Silent Reminders!
Always on the job with real practical safety Sign Brains and system back of them

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Jumble of words on a steel plate

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Our stock covers a thousand other kinds

SEND FOR CATALOG

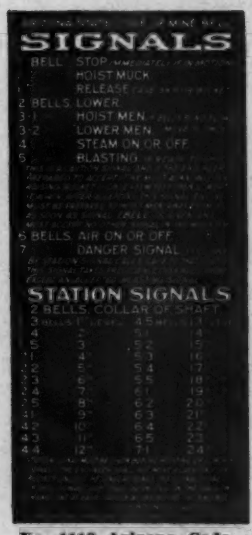
HOISTING CODES and OTHER SIGNS for MINES

No two states use the same code of mine bell signals. Miners are a wandering class. No miner can remember every state code. The above man, from another state, his first shift, what is he to do? Take a chance on that bell cord, or wait for the shift boss? In any case the company pays for the loss of time. Suppose he gives the wrong signal and there is an accident—the company is liable—to the state for not having a legible code posted—to the miner if he is injured,—and for damage to the mine.

A code that is not at all times legible does not comply with any state law.

These Enameled Steel Signals and Signs for mines are made by fusing pure imported enamels on a sheet of steel under 1,600 degrees of heat, and are impervious to all underground mine conditions. They wear forever.

We carry numerous STATE MINE CODES in stock. We will make any State Code not in stock to order. Price quoted upon receipt of copy and quantity required.



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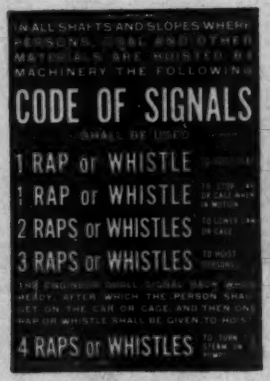

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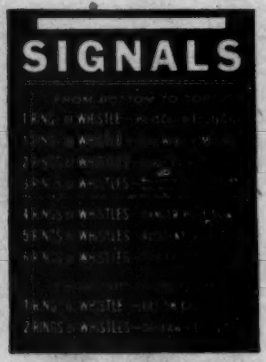

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Size 14x20 in.

Station and Level Signs 3 in. x 9 in. All other signs (except Codes) are 7 in. x 10 in. Made of 18-gauge Steel Porcelain Enameled. $1.10 each.

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October 17-22, 1921

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THIS edition carries the advertisements of the leading manufacturers of mining machinery and equipment. They are entitled to your careful consideration. The advancement of the industry is of paramount importance to them, as it is to the operator. This is evidenced in their generous support of our organization, through The Mining Congress Journal. We wish to take this means of expressing our great appreciation of their support, and to ask that our members keep in mind that, all things being equal, those who cooperate with us in our work are entitled to their first consideration.

THE AMERICAN MINING CONGRESS.

W. J. LORING,
President, The American Mining Congress
1920-1921

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"PAY BACK AND WORK BACK"

THE WAY TO PROSPERITY was definitely pointed out by two high officials of the federal government in addresses delivered on Labor Day. Miners, farmers, manufacturers, traders and laborers may all profit by reading and interpreting and applying in their business the common-sense preachments of Vice President Coolidge and Secretary of Labor Davis.

The Vice President, speaking at the celebration of the one hundred and fiftieth anniversary of the founding of Williamsburg, Mass., said:

"Economic success will be found, not in resisting, but in obeying economic laws.

"It may seem at first glance a hard and cruel doctrine that the government cannot take from the people the burdens and the responsibilities of existence, . . . but in America the government does not make business. It can assist, it can open opportunity, but here the people of the nation make the business of the nation. All that can be done by the states or the federal government will be in vain without a proper attitude on the part of the people. No power on earth can immediately restore pre-war conditions. The only way to come back to them is to pay back and work back."

An equally eloquent plea for a revival of the gospel of work was made by Secretary Davis, who said:

"This nation has become the greatest of all producing nations. It has become so great because it works—because it always has worked.

"Just now we are in the depths of a depression. Everybody is interested in the way out. And we have made up our minds that the way to prosperity is to work. Just now work is more important to us than anything else.

"Labor Day this year calls everybody to work. The work to be done is to improve the present situation, and anybody can take a hand.

"The business leader must work to start the wheels of industry going again, and bid farewell to wartime profits.

"The toiler must work among his kind for the creation of a spirit willing to say good-by to unreasonable demands.

"The banker must work to provide credits for the re-establishment of business. The skilled engineer must work to cut down costs.

"There is that kind of work for every man, woman and child in the country. We must labor to build up the old spirit of confidence in our people."

The Vice President and the Secretary have risen to eminence and positions of great usefulness to their fellow men by practicing all their lives the doctrine they are now preaching. Secretary Davis as a day laborer never worried about a little overtime, and he didn't stop with eight hours work when as a member of the Cabinet he went to Chicago and prevented a strike which threatened to cut down the world's food supplies. Calvin Coolidge was a poor boy, but hard work made him [illegible] of one of the greatest states and today he is not afraid, in addition to performing the particularly laborious functions of his own office while Congress is in session, to carry the burden of being a Cabinet member without portfolio. The wide experience and broad viewpoint of Vice President Coolidge and Secretary Davis commends their Labor Day utterances to all bona fide seekers after a return of real prosperity.

No one wants to see wages cut below the living point, but a wartime wage is not a living wage. No one wants to see business conducted for less than a just and reasonable profit, but wartime profits are no longer just or reasonable. It is better to operate upon diminished profits than to close up shop, better to work longer hours or for diminished wages than to be idle. Neither the profiteering employer nor the profiteering employe can travel very far or very fast on the road to prosperity. No one will give them a lift, and when they fall no one will pick them up. The merchant and manufacturer who refuse to deflate their prices, the railroad which cuts wages and then declines to meet shippers half way, the mine workman and the printer and the carpenter who insist upon less and less work and more and more pay are equally wrong, equally un-American, equally behind the times and equally in the way. It is time for them to get out of the middle of the road and make room for those who realize that the way to prosperity is labeled, "Pay back and work back."

ARMED GUARDS

THE SMOKE SCREEN IS NEW, but its basic principle is old and its use is by no means restricted to nations at war. We see it resorted to every day and it is a preferred weapon among disputants who have the misfortune to be on the wrong side. In ordinary parlance it is called "beclouding the issue," "dodging the question," or "setting up a straw-man."

Just now the favorite stratagem of the agitators, both of the professional and the parlor variety, is to inveigh against the employment of armed guards to protect private property, especially during labor troubles. Following the recent insurrection in West Virginia, the Washington legal representative of the so-called strikers gave out an interview in which he said:

"The dominant reasons for the outbreak are to be found in the perpetuation of the armed guard system in the state."

He then complained bitterly that the coal operators had employed private detectives and paid the salaries of deputy sheriffs. Other apologists for the disturbers insisted that they should be permitted to retain their arms so long as the members of the state constabulary carried weapons.

It is all a smoke screen, a palpable attempt to dodge the question, to becloud the issue, made with the insolent assumption that the public is simple-minded enough to be led away from consideration of the facts and issues actually involved. It is as if a band of I. W. W.'s, frustrated in their attempts to fire a wheat field or wreck an

ordnance plant, should complain that blood was shed only because the wheat field and the ordnance factory were protected by armed guards. No court of law would countenance such a pleading or squander its time by considering it for one minute, and neither will the court of public opinion give ear to such a whining, hypocritical plea in the case of industrial disturbances. The public will kick the straw man out of the way, go behind the smoke screen and lend the weight of its support to the forces of law and order.

No valid objection can be raised to the employment of armed guards. The only argument ever advanced against the practice is that ample protection to life and property should be provided by the constituted authorities. But this argument is pointless because it is a theory only and no theory ever yet dismayed a thief or frustrated a burglar or turned back a mob bent on destruction. A guard is a watchman, nothing more and nothing less. Watchmen are generally armed. Their employment is universal and sanctioned by law and custom and public opinion. Every towering office building, every large apartment house has its armed guard, or watchman. Every bank, every large hotel, every baseball park and every department store employs private detectives, or armed guards, who are generally either sheriff's deputies or members of the police force and who receive salaries from the persons and firms whose property they protect. The bank messenger, jeweler's clerk and broker's agent carrying through the streets a satchel filled with valuables is often accompanied by armed guards, although there are policemen on every corner. Railroads maintain extensive secret service departments.

In every city in the land merchants club together and employ armed watchmen to make the rounds of their stores at regular intervals during the night, thus securing a greater measure of safety than that which the municipality provides. In the city of Washington, which certainly is as civilized as any municipality on earth and which has an exceptionally capable police department, the national government stations armed guards in its own buildings, despite the fact that the government pays its just proportion into the city's treasury and receives therefor all the protection afforded to citizen taxpayers. The American Federation of Labor has in Washington a magnificent office building known as the "labor temple," and this temple is guarded every night by a special policeman who holds a commission from the District of Columbia which empowers him to carry arms. This is the same "labor temple" wherein are maintained the offices of President Samuel Gompers and the head of the Mining Department of the American Federation of Labor, who object so strenuously to the employment of armed guards at the mines. And the attorney quoted above as attributing all the trouble in West Virginia to the employment of armed guards maintains his own office in one of Washington's marble skyscrapers which is protected by privately employed armed guards both day and night.

Private employment of armed guards has always been customary wherever there is valuable property to protect, irrespective of the character or location of the property. The taking of such precautions can in no wise be regarded as an offense against honest citizens, for they are purely defensive measures aimed only against persons bent on robbery, arson or other destruction. No thinking man would ever suggest that armed guards be withdrawn from banks, express offices, and diamond shops, or that the use of private detectives be forbidden at race tracks and in stores, hotels, and theaters, for he would know that by so doing he would give just cause for questioning his sanity or his honesty. And when labor agitators rail against the employment of armed guards, especially during strikes, they lay themselves open to suspicion. Either they must admit that their intentions are not of the best, or confess that they hope to deceive the public.

Can it be that the agitators believe that the taking of protective measures is justifiable only when industrial peace reigns and everybody is happy, but that mine guards, private detectives and state constabularies should be discharged upon the instant that a strike, lock-out or "vacation" is proclaimed? Or can it be that they believe the American Federation of Labor and attorneys for outlaw coal mine workmen should be permitted to employ private detectives, but that mine owners, railroads and others with valuable property should not? If so, their credulity is pitiable. The American public would never approve such injustice, never countenance such insanity.

There will come a time, of course, when watchmen will no longer be employed; we cannot say exactly when. We are not sufficiently versed in theology to predict the date of the millennium.

CO-OPERATION THE ESSENTIAL FACTOR

AMERICAN INDUSTRY is facing a period of unprecedented competition. Every returning traveler brings reports of the speeding up of the German industrial machine—and every seaport in this country furnishes evidence of the ability of European manufacturers to place products in the American markets at prices below the domestic costs. Efficiency in production must be the watchword of American producers if our industries are to maintain a continued development.

The effective mobilization of American industry during the war indicated the possibilities of standardized methods, and coordinated efforts. The demobilization of industry after the war furnished the best evidence of the dangers of the failure to provide for a continuance of co-operative effort, and of establishing teamwork between the basic factors in industrial progress.

During the last eighteen months there has been a continual conflict between labor and the employer, between the carriers and the shipper, and in many industries there has been a cut throat competition resulting in industrial demoralization between individual producers. Such conditions if continued will inevitably result in the failure of American industry to meet present day conditions, and no amount of protection or government assistance can prevent the stoppage of production and the cutting down of plant capacity.

Realizing these facts which are particularly applicable to the mining industry the American Mining Congress at its Twenty-fourth Annual Convention will devote a considerable part of its program to the development of teamwork and co-operation between the mine producer, the manufacturer of mine equipment, and the railroads in the hope that through such co-operation a constructive program can be created wh ch will be of far-reaching benefit both to the industry and to the nation.

If American industry is to effectively meet world competition—provision must be made under wise and farsighted regulation for co-operative effort in the continued production and distribution of products.

By intelligent analysis of the difficulties, by harmonizing divergent opinions, and by co-operative thought, followed by vigorous initiative the American Mining Congress through the conferences and discussions at the Convention hopes to see the formulation of a platform which will inaugurate a new era of mine production and of National prosperity.

THE HIGH STANDING OF THE FOURTH ESTATE

A UNIQUE TRIBUTE TO THE PRESS was contained in the report made to the War Department by Brig. Gen. H. H. Bandholtz, to whom was entrusted the pacification of the coal mining counties of West Virginia. As the climax to his recital of the circumstances which led him to believe there would be no further disorder, and in support of his recommendation that martial law be not declared, he said:

"Many newspaper correspondents are leaving, which would seem to indicate they consider the situation no longer menacing."

It is a far cry from Kitchener, who contemptuously included the correspondents in an order sending all "camp followers" to the rear, to Bandholtz, who as the general in supreme command makes known his reliance upon the good judgment of the representatives of the press in the most serious situation which has arisen in this country since the Civil War. But the world has advanced in the last few decades and the press has been out in the forefront of the procession of progress showing the way to others.

The statement of Bandholtz was more than a tribute, which might easily amount to nothing more than a compliment or a mere bouquet. It was an acknowledgment of the breadth of observation, ability for making deductions, precision of interpretation and absolute reliability of the modern newspaper man. It constituted a formal recognition of the high standing of the Fourth Estate, bestowed with all the dignity and seriousness which marks the conduct of state affairs. As such it was undoubtedly intended, as such it will be received and as such it was altogether deserved.

RAILROAD RATES AND POTENTIAL TONNAGE

UNDER GOVERNMENT REGULATION and management, the trend of railroad rate revision was constantly upward and transportation rates were increased until the burden upon the great mining and manufacturing enterprises of the country, which furnish the major portion of the tonnage hauled, reached enormous proportions.

Recent reports indicate that the high rates now in effect are more than the traffic will bear, and that instead of yielding larger revenues to the carriers they have resulted in a loss of revenue because many industries which formerly were large shippers are now unprofitable. This is true particularly in the case of mines containing large quantities of low grade ores. High railroad rates, high taxes, and lack of tariff protection have compelled these mines to either close down or confine their operations to the production and exhaustion of their highest grade minerals, or surface ores, thus making impossible in many instances the future development and recovery of the low grade product. This situation is not only lessening the volume of present tonnage, but is seriously impairing potential tonnage of the ore carriers.

The density of traffic in the mining regions and thickly populated sections of the country makes possible the maintenance of adequate service for the agricultural districts and sparsely settled localities where the volume of traffic is comparatively small. It is, therefore, of vital importance to the railways of the country not to maintain a rate level which results in the loss of potential tonnage; and now that the roads have been returned to private management it is essential for their owners to plan wisely in the development of a policy for the future which will secure not only the adequate maintenance of existing lines, but provide for increased facilities which will stimulate the growth and keep pace with the requirements of our commerce. This program can be accomplished only through the adoption of a policy of general revision downward, especially of rates on the raw and finished products of natural resources, which will help to encourage the extraction and utilization of low grade ores simultaneously with the mining of the high grade ores. Lower rates will tend to increase the present and potential ore tonnage of the railroads and thus will stabilize and augment future earnings.

THE MINING CONGRESS JOURNAL

WE HAVE NO COMPETITOR. THE MINING CONGRESS JOURNAL is one of the comparatively few important publications which can say to others who serve the same field that it wishes them well. We admit—even boast—that other mining publications are of the very highest calibre and congratulate them upon their growing influence. Our interests are mutual.

In America, where organized effort has reached its highest stage of development, a knowledge of current events is a pre-requisite to successful endeavor. Hence the development of the daily newspaper, chronicling the happenings of the preceding twenty-four hours and making appropriate comment thereon. From the daily newspaper, serving the whole public and of necessity restricting its contents to matters of general interest, it was a normal and natural forward step to the weekly and monthly magazine prepared especially for those engaged in identical lines of business or in similar arts, sciences and professions. There are printed in America more and better agricultural, religious, fraternal, scientific, and trade and class periodicals than in any other country. The trade and class publications alone number more than 5,000 and their circulation runs into the millions.

The trade and professional mining publications devote their pages to the discussion of scientific matters, or to the news of limited territories or of some particular branch of the mining industry. THE MINING CONGRESS JOURNAL interprets the economics, the national phases of the business side of mining, and mirrors official Washington to the entire industry. The business of mining is directly and peculiarly sensitive to every enactment or repeal of national legislation or even the suggestion thereof, and to every administrative order entered or revoked at Washington. The industry must needs be kept continually informed, and the function of THE MINING CONGRESS JOURNAL is to meet this need. No other mining magazine has for its primary object the dissemination of Washington news or the news of the American Mining Congress and its chapters. THE MINING CONGRESS JOURNAL does not duplicate. Our field is exclusive; our mission, imperative. Now that the public is beginning to realize that mining is fundamental to the nation's prosperity, this field must be covered more intensively, this mission must be fulfilled all the more faithfully. The industry stands in need of all the scientific data, all the political and economical information, all the constructive publicity it can get.

THE MINING CONGRESS JOURNAL is gratified to feel that its efforts will be made in co-operation, not in competition, with the scientific press, which will continue to render in the technical field a service of inestimable magnitude. There is room for all, work for all. Our interests are mutual.

BUSINESS CONDITIONS IMPROVED

THE TIDE HAS TURNED. The good ship Prosperity, after floundering about so long in uncharted stormy seas, is headed straight for shore and ready to make a landing upon signal from port.

In referendums conducted by two great daily newspapers, the Cincinnati *Times-Star* and the Philadelphia *Public Ledger*, men whose abilities and facilities for surveying the situation accurately are unsurpassed expressed their belief that business had already passed through the valley of depression and was on the up-grade. Their statements were sufficiently at variance to mark them as having been given in good faith, sufficiently in agreement to indicate a prevailing view of healthy optimism.

The award of Judge Kenesaw Mountain Landis promises to eliminate stagnation in the building trades and relieve the housing situation. Its effects will be national, as it will put thousands of men to work and renew their purchasing power.

The recent rise in the cotton market is one of the most hopeful signs of the entire year. Thirteen states have been lifted out of near-bankruptcy and supplied with the wherewithal for purchasing wheat, corn, fruit and other raw commodities from the west and manufactured articles from the east. This one favorable turn of the market will benefit every part of the country.

Tax legislation has progressed to the point where business at least knows its profits will no longer be confiscated. Shipping Board problems have, in a way, been solved. Money is easing up. The Federal Reserve Board regularly sounds encouraging notes in its official pronouncements. Passage of the funding bill or adoption of some other government measure for relieving the financial embarrassment of the railroads apparently is assured, presaging wide-spread resultant activity in other lines. A renewal of railroad buying on the old-time scale will mean employment for thousands of laid-off men; the purchase of lumber, iron, steel and coal, entailing a resumption of activity in these and connected industries.

The mining industry, always alert, always sensitive to changes in other lines, will come in for its share of the enlarged business which now seems inevitable. It could not be otherwise, for mining is a basic industry and its products are indispensable alike to the manufacturer, the jobber, the retailer, the railroad and the consumer. Silver-lead mining will be the first to feel the change; zinc will come next and the other minerals will follow. Six months should find the great American mining industry again in the heyday of prosperity—not, of course, the inflated kind of prosperity which the war brought, but the solid, well-grounded, lasting prosperity which the country knew in former years and which, when once re-established, may reasonably be expected to continue for many years to come.

As Postmaster General Hays so tersely put it, prosperity is already on the road for those who will go out and meet it.

THE GOLD CONFERENCE

ALL GOLD PRODUCERS will be particularly interested in the letter written by Senator Tasker L. Oddie of Nevada to Secretary of the Treasury, Andrew W. Mellon, on August 17 and the gold resolution signed by twenty-two senators which are published elsewhere in this issue. While awaiting the detailed reply of Secretary Mellon, no proposal for the relief of the gold mining industry could properly come before the gold conference at the forthcoming annual convention of the American Mining Congress, but a report will be made detailing the activities of this organization in behalf of he gold mining industry.

GUILTY

THE BLACKEST PAGE in the history of union labor was written in West Virginia during the last week of August and the first few days of September. No amount of explanation or protestation can wipe it out; neither sophistry nor misrepresentation can explain it away. The United Mine Workers is responsible for the break-down of the government of a sovereign state, for an assault upon the flag and the constitution and for the death of uniformed soldiers and inoffensive citizens.

There is no strike in the non-union counties in West Virginia, and never has been. There is no controversy between the workmen and the employers, and never has been. When the international organizers for the U. M. W. of A. went into the field a majority of the workers refused to have anything to do with them. They remained at work, have been and are still at work and ask only that they be permitted to continue at work. The mines are fully manned and their production is the highest in the world. The insurrectionists have no more right to demand jobs in the mines of West Virginia than in the oil fields of the west, in the iron mines around Lake Superior or in the plants of the United States Steel Corporation.

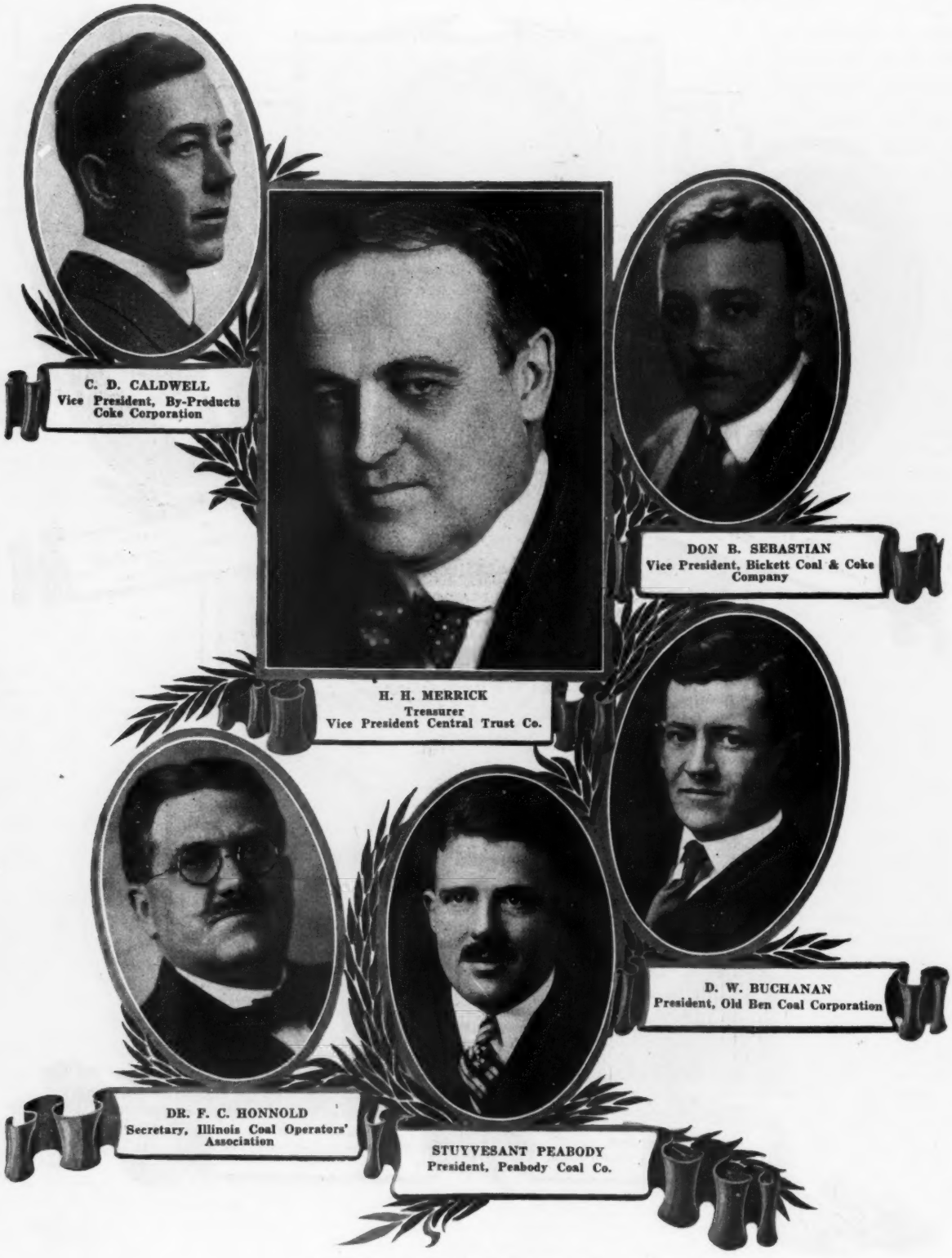
Of the few who looked with favor upon the initial attempt to organize a union, a few quit their jobs and others were discharged for offensive conduct. Men who walk out or are locked out and join a union afterwards cannot be called strikers, but it was they and others who never worked in the affected field who carried death and destruction into Logan County. They were outsiders, aliens who sought to drive out the inhabitants and possess themselves of the land, and they had exactly the same justification for their conduct that the Moorish hordes had for invading Spain, that the Tartars had for over-running northern Europe and that the Germans had for blasting their way through Belgium.

While the trouble in Logan County was at its height, the president of the American Federation of Labor and the head of the federation's mining department called upon President Harding and asked him to call a conference of the union and the operators. The president of the United Mine Workers of America in a public statement made a similar request. President Harding will not call the conference. The operators have no need for the services of the union. Under the laws and the constitution, the union cannot force its services upon them. Hence there would be nothing to talk about.

But there is one conference which should be held, and at which there would be a great deal to talk about and a great deal to be done. That should be a conference of the executive board of the American Federation of Labor, called for the purpose of receiving a report to the effect that the United Mine Workers of America have expelled every officer and member who participated in the West Virginia insurrection and will co-operate in their prosecution in the criminal courts. If this report is not forthcoming, then the Federation of Labor should expel the United Mine Workers of America.

Those who aid and abet in the commission of a felony are equally culpable with the principal. Unless organized labor promptly disavows the murder and insurrection committed in West Virginia, it will be called to account before the court of public opinion and the verdict will be, "Guilty."

The Chairman and Members of the
ILLINOIS COMMITTEE ON ARRANGEMENTS



The Treasurer and Members of the
ILLINOIS COMMITTEE ON ARRANGEMENTS

The Exposition Chairman and Members of the
ILLINOIS COMMITTEE ON ARRANGEMENTS

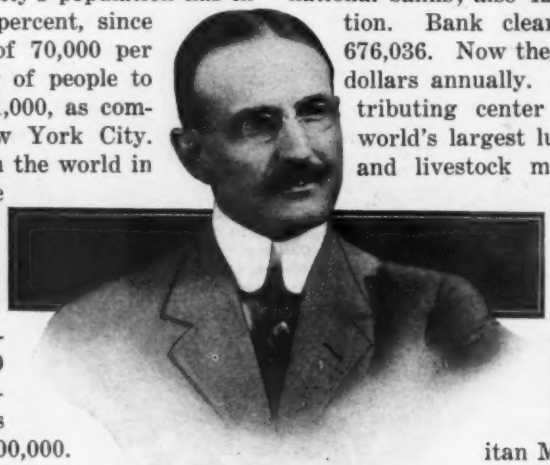
Members of the
WAYS AND MEANS COMMITTEE

Members of the
EXHIBITS AND INSTALLATION COMMITTEE

CHICAGO

The 1921 Convention City

DELEGATES to the 1921 convention of the American Mining Congress will visit one of the wonder cities of the world. Chicago in 71 years has grown from a town 14 miles in area to a metropolis covering 200 square miles, and in population from 28,269 to 2,701,705. Including its suburbs, themselves large enough to rank as cities above the average in size, Chicago's population is well above 3,000,000. The city's population has increased by 700,000, or 32 percent, since 1900, or an average gain of 70,000 per year. The average number of people to the square mile is about 11,000, as compared with 130,000 in New York City. Chicago is the fourth city in the world in size, and the second in the United States.



JOSEPH R. NOEL
President, Chicago Association of Commerce. The Association has given valuable co-operation to the Convention management and the Illinois Committee on Arrangements

Chicago is the largest industrial city in the world. It has within its manufacturing zone over 20,000 factories with an output in 1919 worth more than $4,000,000,000. In 1860 the city's output was valued at $20,000,000. Chicago has the largest number of skilled mechanics in the world.

Chicago is the largest railroad center in the world. Its system of belt lines comprises one-third of the total in the United States. Thirty-nine roads enter the city and a train leaves every minute. Twenty-five hundred through package cars leave the city daily for 1,800 primary destinations. Every passenger train carries 133 passengers a minute, making 192,000 who arrive and depart daily. Seventy million people come and go to and from Chicago annually.

Chicago has an annual vessel tonnage of 15,000,000 tons, 101 miles of water frontage for the handling of its water borne commerce, of which 52 miles are equipped with dock and railway facilities. Its outer harbor has a frontage of 24 miles. The chief business of the Chicago River is the transportation of lumber, coal and package freight. From the Calumet River are served the many industries of South Chicago, East Chicago, Indiana Harbor and Gary by rail connection. Around this port are grouped steel mills, furnaces, smelters, forging plants, foundries and grain warehouses. The lake commerce of 1920, considering receipts alone, included the following products of the mines: hard coal, 736,976 tons; soft coal, 686,638 tons; iron ore, 6,496,034 tons; salt, 76,900 tons; manufacturers' iron, 13,721 tons; limestone, 1,448,855 tons.

Although Chicago is an inland city, in one year merchandise valued at more than $18,000,000, pass through its custom house on which $4,695,984 was collected as duty. Chicago's surface transportation lines number 172, and they use more than 1,000 miles of track and 575 transfer points.

Chicago has 98 savings and state banks, 10 trust companies, 34 trust and savings banks and 25 national banks; also 422 theaters of every description. Bank clearings in 1876 were $810,676,036. Now they are well over thirty-billion dollars annually. Chicago is the jewelry distributing center of the world and is the world's largest lumber market, grain market and livestock market. The city's packing houses in 1919 killed 8,359,895 hogs. Chicago is the world's center for the manufacture of electrical and gas devices. Its famous Art Institute has a larger membership and in 1920 had a larger attendance than New York's Metropolitan Museum of Art.

Chicago has 2,112 miles of paved streets and the greatest number of small parks and playgrounds of any city in the world. In 1850 the city had seven schools, thirty-five teachers and 3,000 pupils. In 1919 there were nearly 300 public schools, 8,883 teachers and 404,275 pupils. Its public schools consist of 264 public elementary schools, 25 public high, one junior college, one continuation and one normal school. Its other educational institutions consist of 202 parochial elementary schools, 22 parochial high schools, 12 Roman Catholic co-educational colleges and academies and 25 Roman Catholic academies for girls. There are also six colleges and universities, 97 music schools and nine law schools.

The city's public properties are valued at $118,570,291, and its postoffice handles the largest amount of parcel post matter of any city in the world. The Chicago Municipal Pier, extending 3,000 feet into Lake Michigan and costing $5,000,000, not only indicates the city's preparedness to handle an increased volume of lake traffic, but is also a remarkable recreational center.

Delegates to the Mining Congress Convention and visitors to the National Exposition will, of course, go to Chicago primarily for business. But hundreds of them have arranged to arrive a few days beforehand, in order to inspect some of the city's industrial establishments, make a tour of its boulevards and view its places of unsurpassed beauty.

TWENTY-FOURTH ANNUAL MEETING OF THE MINING INDUSTRY

EVERY STATE in the Union, and Alaska and Mexico, will be represented at the Twenty-fourth Annual Convention of the American Mining Congress, which will be held in Chicago, October 17–22. Headquarters will be at the Congress Hotel, the National Exposition of Mines and Mining Equipment will be held at the Coliseum, and general sessions and group meetings will be held at each place.

Every indication points to a notable gathering. Legislation, the general business situation and world conditions present problems of first importance to the nation and whose solution is vital to the mining industry. Mining leaders will gather around the council table to talk them over and lay plans for taking advantage of the opportunities which the next year is expected to offer.

There will be three divisions of convention actitities—the general sessions, the group sessions and the exposition. In arranging the program of the convention an effort has been made to bring out those themes for which concerted action is possible.

Co-operative organizations have proven their benefit to the agricultural producer, stabilizing the production and distribution of his products. Mine operators cannot co-operate in this way without violating federal law. The question of the benefits and disadvantages of co-operative effort in the production and distribution of mine products will be presented in Chicago, together with suggestions as to the possibility of modifying the organic law in such a way as to benefit both the public and the mine operator.

STANDARDIZATION—Standardization is the elimination of waste. Standardization was one of the essential factors which made possible the effective mobilization of American industry during the war. The continued development of mine production in the United States is largely dependent upon the development of greater economy in production. Standardization of mining methods, machinery and equipment is therefore a salient question for the mine operator. The National Conference on Standardization at the Mining Congress convention will present the work which has been done during the past three years by the Standardization Division of the Congress and will be of special interest to the mine executive.

E. C. PORTER

Convention Manager, American Mining Congress

TRANSPORTATION—The mining industry furnishes over sixty percent of all freight traffic. Transportation in turn is frequently the determining factor in the production and distribution of mine products. Freight rates are high, yet the railroads are still in a serious financial situation. Is it possible to develop a policy which will mutually benefit both of these industries? One session of the convention will be devoted to a discussion of this question, both from the standpoint of the railroads and of the mine operator.

NEW USES FOR METALS—If capacity production in a number of the basic metal mining enterprises is to be maintained in this country a greater use of metal products must be developed in the domestic markets. This is a subject which affects the interest of every metal producer. Intensive studies are being made of the possibilities for developing better marketing methods and new uses for metal products. The results of several of these investigations will be presented at the Chicago convention, and an opportunity will be given for a thorough discussion of the entire subject.

TAXATION—There is no subject of greater interest to the mine operator than taxation. The tax problem in the United States is the greatest barrier to increased business activity. This is true not only of federal taxation but also of state taxation. The question of mine taxation and of mine valuation is of vital importance to the mining industry, and the effective work which has already been done by the Mining Congress in preventing unfair and discriminatory taxation of mine production will be effectively supplemented and developed at the convention.

GOLD—As a result of the war the United States is now holding the gold reserves of the world. It is the only country on a strictly gold basis. In the depreciated currencies abroad is seen a latent threat to the gold standard. Furthermore, the production of gold as a result of high costs has been steadily decreasing. The question of protecting the gold standard, and of preventing a further decrease in our gold production, will form one of the important convention topics.

COAL—The coal industry is essential to our industrial production. During the last three years the coal operator has been subjected to continual abuse and misrepresentation. The coal industry stands in need of a wise, far-sighted policy representing the best thought in the industry. The formulation of such a policy and its presentation to the public would do much to bring about a greater understanding and appreciation of the problems which confront the coal operators. The sessions of coal operators will be among the largest and most important of the entire convention.

FOREIGN POLICY—The United States is no longer isolated. Our foreign relations have a direct affect upon the continued development of the mining industry. There are increasing opportunities for the utilization of American capital and organizing ability in the development of mining interests in all parts of the world. What is to be the attitude of the mining industry in regard to our

foreign relations? The sessions devoted to the problems of our foreign relations in connection with the mining industry will be among the most important of the convention. There will be a number of special delegations from Latin-American countries present at the conferences on foreign trade and foreign policy.

PETROLEUM—Closely allied to the question of an American foreign mineral policy is the question of the maintenance of our petroleum production both at home and abroad. A special conference of oil producers will be held in Chicago, and these conferences will include a session devoted to the oil shale industry.

EDUCATION—The effective training of mining engineers, the vocational education of employes and the development of closer co-operation between the technical schools and the mine operator will be discussed.

EXPOSITION—One of the essential factors in the development of American industry has been the continued introduction of effective labor-saving machinery. Lower costs in mine production are necessary at the present time. Proper machine equipment is therefore indispensable. Two hundred representative manufacturers of mine machinery and mine equipment will have exhibits at the Chicago convention. The American Mining Congress has attempted in building up this exposition as an integral part of the convention to give to the mine executive the best opportunity ever afforded of studying the equipment which is so essential a factor in the future development and continued maintenance of mine production. In addition to the manufacturing exhibits, there will be many official exhibits, including a special exhibit of the oil shale industry by the Bureau of Mines. The Geological Survey, other government bureaus and numerous states will also have exhibits.

Two of the important exhibits in the central Plaza will be from Alaska and Mexico. Each of these countries offers almost limitless opportunities for mining development.

A special and more detailed article on the Exposition will be found elsewhere in this issue.

The Utah Chapter of the American Mining Congress, working in co-operation with Governor Mabey and Senator Smoot, has secured from the Postoffice Department permission to obtain the use of an airplane for making photographs of Utah mining camps to exhibit at the Chicago convention. The Mining Committee of the Salt Lake Commercial Club has taken an especial interest in the preparation of the Utah exhibit, having appointed a special committee composed of F. B. Cook, Charles Peters and Harry S. Joseph to render financial and other assistance.

The California exhibit is being prepared by Secretary William W. Thayer of the State Mining Bureau. Gold will be the main feature, specimens aggregating $50,000 in value being shown. Every mineral product in the United States except phosphate is found in California, so the state's exhibit will be a varied one. It will occupy 700 feet of floor space in the coliseum and will be in charge of Walter M. Bradley, statistician and curator of the state mining bureau. Governor W. D. Stephens will name California's five delegates.

California will display its mineral products at the American Mining Congress convention. The exhibit is being prepared by Secretary William W. Thayer of the state mining bureau. Gold will be the main feature, specimens aggregating $50,000 in value being shown. Every mineral produced in the United States except phosphate is found in California, so the state's exhibit will be a varied one. It will occupy 700 feet of floor space in the Coliseum and will be in charge of Walter M. Bradley, statistician and curator of the state mining bureau. Governor W. D. Stephens will name California's five delegates to the convention.

A majority of the delegates will arrive on Saturday, October 15, or Sunday, October 16. All day Sunday will be given over to registration. Delegates and visitors are urged to present their credentials at the registration desk immediately upon their arrival in order to secure tickets to the Exposition.

MINES BUREAU OFFICIALS ON LONG INSPECTION TRIP

DR. H. FOSTER BAIN, director of the Bureau of Mines, and other officials left Washington late in the summer for an inspection trip which will end with a visit to the American Mining Congress convention in Chicago. They first attended the National Mine Safety Meet at St. Louis, September 1–3, and thereafter left on the following intinerary: Rolla, Mo., Sept. 5; Joplin, Mo., 6 and 7; Kansas City, Mo., 8; Denver, Colo., 9-10 and 11; Casper, Wyo., 12; Basin, Wyo., 13-14; Billings, Mont., 15; Great Falls, 16; Butte, 17-18 with possible trip to Anaconda, 18; en route (stopping at Missoula) 19; Wallace, Idaho, and Spokane, Wash., 20; Moscow, Spokane, and Seattle, 22; Seattle, 23-24-25; Portland, 26; en route 27; Salt Lake City, and Ogden, 28-29; Reno, Sept 30, October 1-2; Oakland, October 2; San Francisco, 4-5; en route 6; Bakersfield, 7-8; Los Angeles, 9-10; Gila, Ajo, Tucson, 11; Tucson, 12-13; Houston, 14; Baton Rouge, 15; Shreveport, 16; Dallas, 17. From Dallas the return will be made via Urbana and Chicago, to arrive Chicago in time for the last two days, October 21-22, of the American Mining Congress convention.

HOUSE MINING CHAIRMAN MAKES TOUR OF THE WEST

FOR THE FIRST TIME in history, in all probability, a Congressional mining committee head is now making a tour of the mining districts of the country. Marion E. Rhodes, of Missouri, chairman of the House Committee on Mines and Mining, is accompanying the director and several officers of the United States Bureau of Mines on a tour of inspection which will include the bureau's field stations and offices, and is also visiting the mines and going underground.

Congressman Rhodes began his trip during the second week in September, when he went down into the lead and zinc mines of the Joplin, Mo., and Miami, Okla., districts. Notwithstanding the re-convening of Congress, he is still touring the western states, and will continue until the middle of the month, when he will go to Chicago to attend the Mining Congress convention. From there he will return to Washington.

THE SECOND NATIONAL STANDARDIZATION CONFERENCE

(Auspices Standardization Division, American Mining Congress)

I. Beginning of Movement and Development of Division

THE SECOND NATIONAL Standardization Conference has been called in conjunction with the Twenty-fourth Annual Convention of the American Mining Congress and the National Exposition of Mines and Mining Equipment, at the Coliseum and the Congress Hotel, Chicago, October 17–22. The First National Standardization Conference was held in conjunction with the Twenty-third Annual Convention of this organization in Denver, Colorado, last year.

The growth of the Standardization Division has been most gratifying. This work was begun two years ago with a small voluntary committee. For a number of years previous to that time the American Mining Congress included among its committees two small committees on the standardization of electrical equipment in coal mines and in metal mines. This work was carried on for several years and several reports were made.

The American Mining Congress, in its efforts to do those things which it has felt would benefit the mining industry, undertook the organization of a National Standardization Committee. The first meeting of this committee was at the St. Louis Convention in 1919. So much interest was aroused on the subject at that time that the chairmanship of the Coal Mining Committee was extended to Col. Warren R. Roberts, president of Roberts and Schaefer Manufacturing Company, of Chicago. Under his leadership the coal committee grew to such proportion that it was decided to organize a Metal Mining Committee, and form a division of the national organization. Chas. A. Mitke of Bisbee, Arizona, accepted the chairmanship of the metal committee. This division of the American Mining Congress is now composed of two branches—the coal mining branch and the metal mining branch. Each of these branches is divided into seven sections, and in addition to these an Advisory Committee on Safety Work was appointed.

With the exception of that done by government departments, such as the United States Bureau of Mines and the Bureau of Standards, no general work had been done on the standardization of mining methods, practice and equipment, until the American Mining Congress organized this division.

It was found as the work progressed that there might be duplication of effort in the work of those interested in the standardization of mining equipment. To avoid this duplication there has been organized what is known as the General Correlating Committee, under the auspices of the American Engineering Standards Committee. This general committee is composed of the American Mining Congress, the United States Bureau of Mines, the National Safety Council, the American Institute of Mining & Metallurgical Engineers, the American Institute of Electrical Engineers and the Associated Companies. Dr. E. A. Holbrook, assistant director of the Bureau of Mines, is chairman of this committee. Several meetings have been held at the Engineering Standards Committee headquarters in New York and the work is now being conducted in the most comprehensive and thorough manner, and duplication of effort is impossible.

The function of this committee as agreed upon at the various conferences is that it will suggest to the American Engineering Standards Committee the subjects for standardization, recommend sponsors to define the scope and limit of proposed standards, assist in adjusting conflicts or clearing up ambiguities, follow up work under way, and report from time to time upon progress made within the field of these activities.

The year 1921 marks splendid advancement in the work of this division. Aside from the formation of the General Correlating Committee, each of the branches has in process the organization of a section on welfare work, and to the metal mining branch has also been added a committee on mine cost accounting of which T. O. McGrath is chairman.

Standardization, the elimination of waste, is one of the most important questions before the mining industry.

The work already accomplished has received the endorsement and cooperation of those associations working along the same lines, and at the second national conference it is proposed to still further consolidate this work. Early in the year the matter of further enlarging the work by the appointment of a mining engineer as chief of the Division, was presented to leading manufacturers and operators. The responses have been most gratifying, and it is possible that within the coming year this plan will be carried out.

There are approximately 160 members of the Standardization Division, each man especially fitted for the work he has in hand by his large experience in matters of this kind. We expect each of the 160 members to be present at the Chicago Conference. In addition, invitations have been extended to practically 2,000 coal and metal operators, asking their special assistance in having present some representative of their company. A similar number of invitations have been extended to the manufacturers of mining equipment and supplies. It is anticipated that there will be large delegations from the various state universities which are considering standardization, from the government departments and the national associations working in conjunction with this division.

Some of the most important addresses of the Twenty-fourth Annual Convention of the American Mining Congress will be delivered to the Standardization Division section.

Dr. Horace Sechrist, Director, Bureau Business Research, Northwestern University, Evanston, Ill., will speak upon "Statistical Standards in Business Research; Dr. P. G. Agnew, Secretary of the American Engineering Standards Committee, New York City, will give a Review of International Standardization. Dr. Agnew has but recently returned from a several months' trip abroad, in the interest of international standards; Dr. H. Foster Bain, Director,

The United States Bureau of Mines, will address the conference upon "Government Interest in Standardization for the Mining Industry;" S. J. Williams, of the National Safety Council, will speak upon "Safety and Standards"; C. R. Thomas, will present a paper upon "Standardizing Research Results Through Publicity"; Dr. E. A. Holbrook, Chairman of the General Correlating Committee, and Assistant Director of the United States Bureau of Mines, will speak upon "National Co-ordination of Standardization Through the General Correlating Committee. The program is not yet complete and many other interesting papers will be presented, not the least among which will be those prepared by Colonel Warren R. Roberts, Chairman of the Coal Mining Branch of the Standardization Division of The American Mining Congress, and Charles A. Mitke, Chairman of the Metal Mining Branch. Mr. Mitke is recognized as an eminent authority upon the subject of "Standardization."

The first meeting of the Standardization Division will take place on Monday, October 17, and meetings will continue until Saturday, October 22. Thursday evening has been turned over by the convention management to the Standardization Division, when this subject alone will be discussed, both from the national and the international standpoint.

Chairman Roberts and Chairman Mitke each will present a general report of the progress of their branch and the chairmen of the various sections will render reports which will be the basis for discussion.

The coal mining branch of the Standardization Division has been in existence one year longer than the metal mining branch. At the convention last year Mr. Mitke's committee had but been organized and little progress had been made in the development of its work. However, due to his earnest effort, rapid progress has been made in the work of the Metal Branch and it is anticipated that much interest will be aroused by the reports to be made from the various sections of this branch of the division.

There have been two changes in the Coal Mining Branch. George R. Wood, who has been chairman of the drainage section, was compelled to resign on account of the necessity for his removal from the West Virginia field to Colorado, and E. D. Knight, of the Cabin Creek Consolidated Coal Company, accepted the chairmanship of this section. For a considerable time Col. Roberts acted as temporary chairman of the Committee on Outside Coal Handling Equipment. The chairmanship of this committee has been accepted by Dr. Henry Mace Payne of Andrade-Eyre, Inc., New York City.

In appointing the chairmen and members of the various sections, every effort has been made to make an impartial selection and have every large mining district and the manufacturers of specialized mining equipment well represented, so that the best talent and experience in the profession will be available and at the command of the committee when the actual work of standardization begins.

The committees are all organized with a view to including the mining operator, the manufacturer of mining machinery and equipment, the United States government and those technical societies which are interested in the development of the standardization movement. The chairmen of the sections are men who are vitally interested in the operating end, or are men who have done considerable original work as mining engineers. We believe that our readers will be interested in having the personnel of these various sections for later reference, and include them as follows:

II. Coal Mining Branch

A. B. KISER
Chairman

UNDERGROUND POWER TRANSMISSION

THE WORK of this section is closely related and coordinated with that of the section on power equipment. Several important meetings have been held, and the work is so well defined that the report which will be presented to the convention will be of the greatest interest. The following well-known gentlemen comprise the personnel of this section:

Harry M. Warren, electrical engineer, D. L. & W. R. R., Scranton, Pa.; W. A. Chandler, Hudson Coal Co., Scranton, Pa.; R. L. Kingsland, general superintendent, P. & M. Dept., Cons. Coal Co., Fairmont, W. Va.; Carl Lee, electrical engineer, Peabody Coal Co., Chicago; L. C. Ilsley, Pittsburgh (Bureau of Mines).

POWER EQUIPMENT

K. A. PAULY
Chairman

The splendid work accomplished by the able chairman of this section during 1920 was more than duplicated during the past year. Various meetings of the committee have been held, and the work is being closely linked with the effort of Mr. Kiser's committee, on underground power transmission. There are sixteen members, all representative men of the mining industry. Those interested in the subject of power equipment should not fail to hear the report of this committee to the annual convention. Its personnel is as follows:

D. C. McKeeham, Union Pacific Coal Co., Rock Springs, Wyo.; G. S. Thompson, Colorado Fuel & Iron Co., Pueblo, Colo.; H. F. Randolph, consulting engineer, Pittsburgh; M. D. Kirk, Pittsburgh Terminal R. R. Coal Co., Pittsburgh; R. W. E. Moore, Westinghouse Electric & Manufacturing Co., E. Pittsburgh; R. L. Kingsland, Consolidated Coal Co., Fairmont, W. Va.; W. C. Shunk, Stonega Coal & Coke Co., Big Stone Gap, Va.; J. T. Jennings, Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.; W. C. Adams, Allen & Garcia, Chicago; O. P. Hood, chief mechanical engineer, Bureau of Mines, Washington; Graham Bright, Westinghouse Electric & Manufacturing Co., Pittsburgh; A. J. Nicht, Allis Chalmers Co., Milwaukee; Stephen H. Green, Pacific Coast Coal Co., Seattle; Charles Legrand, Phelps Dodge Corp., Douglas, Ariz.; Martin J. Lide, consulting engineer, Birmingham, Ala.; C. D. Woodward, chief electrical engineer Anaconda Copper Mining Co., Butte, Mont.

C. E. WATTS
Chairman

UNDERGROUND TRANSPORTATION

The work of this section has grown in importance under the direction of Mr. Watts. Several meetings have been held during recent months, and the report which will be rendered to the annual convention indicates that very substantial progress has been made in reaching conclusions and in making recommendations for the standardization of underground transportation including mine track gauges, track clearances, track curvatures and other important subjects relative to underground work. Every effort has been made to secure the most able men upon this section, with the following result:

Charles M. Means, consulting engineering, Pittsburgh; Graham Bright, Westinghouse Electric & Manufacturing Co., E. Pittsburgh; Joseph Bryan, General Electric Co., Pittsburgh; F. C. Coseo, Jeffrey Manufacturing Co., Columbus, Ohio; D. F. Lepley, general manager, Connellsville Manufacturing & Supply Co., Connellsville, Pa.; C. W. Larson, engineer, mining dept., General Electric Co., Erie, Pa.; E. A. Watters, general superintendent, Hicks' Coal Companies, Leechburg, Pa.; J. Milliken, President, Industrial Car Mfgrs. Inst., Pittsburgh; A. H. Ehle, general sales manager, Baldwin Locomotive Works, Philadelphia; H. K. Porter, mine car department, Hyatt Roller Bearing Co., New York; Frank S. Barks, president, Lincoln Steel & Forge Co., St. Louis; Fred Norman, chief engineer, Allegheny River Mining Co., Kittanning, Pa.; T. A. Parker, Hannibal Car wheel & Foundry Co., St. Louis.

MINING AND LOADING EQUIPMENT

Early in the year C. A. Cabell, of the Carbon Fuel Company, Carbon, W. Va., accepted the chairmanship of this section. Previous to that time Carl Scholz, of Charleston, W. Va., had acted as chairman, and under his leadership a well organized committee was formed. An interesting report will be made to the convention, and extensive plans for future work will be discussed. The work of this important section is being carried on by such well informed men as:

D. J. Carroll, Chicago, Wilmington & Franklin Coal Co., Benton, Ill.; E. N. Zern, mining engineer and editor *"Mining Catalog,"* Pittsburgh; Carl Scholz, general manager, Raleigh-Wyoming Coal Co., Charleston, W. Va.; N. D. Levin, Jeffrey Manufacturing Co., Columbus, Ohio; J. M. Clark, Clark & Krebs, Charleston, W. Va., M. Mitchell, Sullivan Machine Co., St. Louis; William Whaley; Myers-Whaley Co., Knoxville, Tenn.; Wm. O. Duntley, Duntley-Dayton Co., Chicago; E. S. McKinley, Denver; Wm. E. Hamilton, Columbus, Ohio, Walter Stevens, Valier Coal Co., Valier, Ill.; S. W. Farnham, mining engineer, Goodman Mfg. Co., Chicago; E. K. Bowers, Morgan-Gardner Electric Co., Chicago.

COL. WARREN R. ROBERTS
Chairman Coal Mining Branch

OUTSIDE COAL HANDLING EQUIPMENT

The work of this section has been carried on by the chairman of the General Coal Mining Branch, Col. Roberts, who found its duties too arduous in connection with the general work. Dr. Henry Mace Payne, of Andrade-Eyre, Inc., New York City, accepted the chairmanship and in the short period already passed since his acceptance has brought forward and co-ordinated the splendid effort made by Colonel Roberts. A meeting of this committee was held in Chicago recently and Dr. Payne is prepared to offer many valuable suggestions through his report for the standardizing of handling equipment. The personnel of this section follows:

DR. H. M. PAYNE
Chairman

G. F. Osler, general superintendent, Carnegie Coal Co., Pittsburgh; W. A. Bishop, general superintendent, Pocahontas Cons. Collieries, Pocahontas, Va.; F. W. Whiteside, chief engineer, Victor American Fuel Co., Denver; Jas. Needham, general manager, St. Paul Coal Co., Chicago; F. G. Morris, general superintendent of coal mines, Republic Iron & Steel Co., Sayreton, Ala.; A. J. Sayres, C. E. Link Belt Co., Chicago; W. J. Patterson, president, Heyl & Patterson Co., Pittsburgh; M. A. Kendall, chief engineer, Stephens-Adamson Mfg. Co., Aurora, Illinois; Warren R. Roberts, Chicago; Rudolph H. Kudlich, assistant to chief mechanical engineer U. S. Bureau of Mines, Washington.

MINE VENTILATION

This committee has made most substantial progress in spite of the general business depression and the necessity for its members to devote all of their attention to business conditions. Mr. Montgomery is to present to the convention a report that will be exceedingly valuable and which will serve as a basis for the work of the committee during the coming year. The work is being carried on by the following able gentlemen:

W. J. MONTGOMERY
Chairman

J. M. Doughty, Lehigh & Wilkes-Barre Coal Co., Wilkes-Barre, Pa.; Howard N. Eavenson, mining engineer, Pittsburgh; Martin J. Lide, Birmingham; G. E. Lyman, general superintendent, Madison Coal Corporation, Glen Carbon, Ill.; E. N. Zern, mining engineer and editor "Mining Catalog," Pittsburgh.

C. D. KNIGHT
Chairman

DRAINAGE

A change was made in the chairmanship of this committee early in the year, on account of Mr. Wood's removal from the West Virginia field. Under the able leadership of Mr Knight the growth of this committee has been most gratifying. Its personnel has been enlarged and much constructive work has been done. Its report to the convention will be one of the most interesting to be presented, and will be the basis for very valuable discussion. The present personnel is as follows:

M. C. Benedict, consulting engineer, Johnstown, Pa.; Walter D. Stockley, Fairmont, W. Va.; E. F. Austin, manager mine pump department, Dravo-Doyle Co., Pittsburgh; Cecil W. Smith, mining engineer, Nokomis Coal Co., Chicago; F. W. Smith, mine drainage engineer, Weinman Pump & Supply Co., Pittsburgh; F. J. Emeny, chief engineer, the Deming Company, Salem, Ohio; Professor John W. Hallock, head of department of industrial engineering, University of Pittsburgh; R. Y. Wert, mine drainage superintendent, Durham Coal & Iron Co., Soddy, Tenn.; J. H. Edwards, electrical engineer, Eklhorn Piney Coal Mining Co., Huntington, W. Va.; L. D. Tracy, mining engineer U. S. Bureau of Mines, Pittsburgh.

III. Metal Mining Branch

UNDERGROUND TRANSPORTATION

The condition of the copper industry has delayed to a certain extent the development of this section. Mr. Daly has given much thought and effort to the work and his committee members have submitted many splendid recommendations for standardization, to be presented through the report which will be rendered to the convention. The personnel of this section is:

WILLIAM B. DALY
Chairman

George H. Booth, mechanical engineer, Inspiration Cons. Copper Co., Inspiration, Ariz.; Andover Syverson, chief eginneer, United Verde Exten. Mining Co., Jerome, Ariz.; E. M. Morris, assistant superintendent of mines, Anaconda Copper Mining Co., Butte, Montana; R. R. Boyd, assistant superintendent mine department, Copper Queen Branch, Phelps Dodge Corp, Bisbee, Ariz.; T. K. Scott, chief engineer Miami Copper Co., Miami, Ariz.; H. T. Hamilton, manager Moctezuma Copper Co., Nacozari, Son., Mexico; R. E. Howe, assistant general manager, Cananea Cons. Copper Co., Cananea, Sonora, Mexico; D. S. Calland, managing director, Compania de Real del Monte de Pachuca, Pachuca, Hidalgo, Mexico.

DRILLING MACHINES AND DRILL STEEL

This section is the largest from the personnel standpoint of any of the sections. In addition to its regular personnel, it has an "inner committee," which acts upon the recommendations made by the general committee. The recommendations made by this section last year were exceedingly practical and received by the industry with enthusiasm. The report to the convention will be comprehensive and will serve as a basis for the further work of the section. The following very able representatives of the mining industry comprise its personnel:

Arthur B. Foote, North Star Mines, Grass Valley, Calif.; Arthur Notman, Copper Queen Br., Phelps Dodge Corp, Bisbee, Ariz.; O. J. Egleston, manager U. S. Smelting, Refining & Mining Co., Kennett, Calif.; Arthur Crane, Hercules Powder Co., San Francisco; C. S. Elayer, Arizona Commercial Mining Co., Globe, Ariz.; J. A. Fulton, Idaho-Maryland Mines Co., Grass Valley, Calif.; L. C. Bayles, Ingersoll-Rand Co., Phillipsburg, N. J.; H. Seamon, efficiency engineer, United Verde Copper Co., Jerome, Ariz.; Ocha Potter, superintendent, Superior Division, Calumet and Hecla Mining Co., Houghton, Mich.; R. T. Murrill, Inspiration Cons. Copper Co., Inspiration, Ariz.; George H. Gilman, East Boston, Mass.; Charles Lees, superintendent, Iron Cap Copper Co., Copper Hill, Ariz.; Charles A. Smith, mine superintendent, Ray Cons. Copper Co., Ray, Ariz.; Roy Marks, stope engineer, United Verde Exten. Mining Co., Jerome, Ariz.; Earl Hastings, foreman, Clay Mine, Arizona Copper Co., Ltd., Morenci, Ariz.; Frank Ayer, mine superintendent, Moctezuma Copper Co., Pilares De Nacozari, Sonora, Mexico; W. G. Scott, superintendent, Coronado Mines, Arizona Copper Co., Ltd., Metcalf, Ariz.; Thos. C. Baker, assistant general manager, The Mexican Corporation, Edificio, La Mutua, Mexico City, Mexico; Charles Officer, Sullivan Machinery Co., Chicago; A. S. Uhler, Ingersoll-Rand Co., New York; George A. Shaw, efficiency engineer, Denver Rock Drill Manufacturing Co., Denver; H. T. Walsh, vice-president, Sullivan Machinery Co., Chicago; R. A. Scott, sales manager, Denver Rock Drill Mfg. Co., Denver; Bruce Yates, Homestake Mining Co., Lead, S. D.

NORMAN B. BRALY
Chairman

Inner Committee, Drilling Machines and Drill Steel—Frank Ayer, superintendent, Moctezuma Copper Co., Nacozari, Sonora, Mexico; H. Seamon, drill efficiency engineer, United Verde Copper Co. Jerome, Ariz.; Charles A. Smith, superintendent, Ray Cons. Copper Co., Ray, Ariz.; Arthur Notman, superintendent, Copper Queen Br., Phelps Dodge Corp, Bisbee, Ariz.; George Gilman, E. Boston, Mass.; H. T. Walsh, vice-president, Sullivan Machinery Co., Chicago; George A. Shaw, efficiency engineer, Denver Rock Drill Manufacturing Co., Denver; L. C. Bayles, chief engineer, Ingersoll-Rand Co., Phillipsburg, N. J.

MECHANICAL LOADING UNDERGROUND

This section was originally called "Underground Shoveling Machines," but was changed later, under the direction of Mr. Eaton, who is superintendent of the Cleveland Cliff Iron Co. properties at Ishpeming, Mich. This section did not render a report last year because it was not yet fully organized. It plans to include in its work the standardizing of general capacity cars for hand transportation, together with gauge of track; all cars for motor haulage, gauge of track, grade of drift, etc. Its first report will be made to the Chicago meeting and will be of more than usual interest. The personnel of this section is:

H. E. Billington, manager of sales, Thew Shovel Co., Lorain, Ohio; J. H. Hensley, mine superintendent, Miami Copper Company, Miami, Ariz.; Albin F. Victor, manager of sales, Lake Superior Loader Co., Duluth, Minn.; H. DeWitt Smith, superintendent of mines, United Verde Copper Co., Jerome, Ariz.; William Whaley, general manager, Myers Whaley Co., Knosville, Tenn.; R. W. Macfarlane, mining department, Longfellow Div., Arizona Copper Co., Morenci, Ariz.

GERALD SHERMAN
Chairman

MINE TIMBERS

Mr. Carmichael, who has been acting as chairman of this section, found his duties too heavy to permit his proper attention to the work, and Gerald Sherman, Bisbee, Arizona, has accepted the chairmanship. A considerable amount of work has been done and the report which will be rendered at the Chicago meeting will outline a program for future work that will be very gratifying to the industry. The personnel of this section is:

W. G. McBride, general manager, Old Dominion Co., Globe, Ariz.; Ira B. Joralemon, assistant general manager, Calumet & Arizona Mining Co., Warren, Ariz.; Felix McDonald, mines superintendent, Inspiration Cons. Copper Co., Inspiration, Ariz.; John Kiddie, division superintendent, Arizona Copper Company, Morenci, Ariz.; W. S. Boy, manager Ray Cons. Copper Co., Ray, Ariz.; T. Evans, general superintendent, Cananea Cons. Copper Co., Cananea, Sonora, Mexico; G. W. Nicholson, general superintendent, United Verde Exten. Mining Co., Jerome, Ariz.

STEAM SHOVEL EQUIPMENT

This section is composed of men especially familiar with the subject and while the same conditions surround its activities as surround those of Mr. Daly's committee, Mr. Goodrich has prepared, with the assistance of the members of the committee, a very comprehensive report which will make practical suggestion with reference to the standardizing of steam shovel equipment. The personnel is as follows:

H. C. GOODRICH
Chairman

Robert E. Tally, general superintendent, United Verde Copper Company, Clarkdale, Ariz.; G. W. Barnhart, manager, San Francisco Branch, Marion Steam Shovel Co., San Francisco; C. B. Lakenan, general manager, Nevada Cons. Copper Co., McGill, Nev.; H. G. S. Anderson, mining and metallurgical engineer, Hurley, N. Mex.

FIRE FIGHTING EQUIPMENT

The work of this section, which was originally defined as "standardizing the type and quantity of fire fighting equipment which should be on hand and available for immediate use at all metal mines," has been under the very capable management of Mr. Connibear, mine inspector of the Cleveland Cliffs Iron Company. Conditions in the Michigan iron ranges have been similar to those in the copper districts, but in spite of business anxiety progress has been made in the work, and a very valuable report will be rendered to the convention. The personnel is:

CHAS. A. MITKE
Chairman Metal Mining Branch

J. T. Young, safety inspector, Arizona Copper Company, Morenci, Ariz.; Orr Woodburn, safety first director, Globe-Miami District, Globe, Ariz.; A. A. Krogdahl, safety engineer, Oliver Iron Mining Co., Virginia, Minn.; Guy J. Johnson, safety engineer, Homestake Mining Company, Lead, S. Dak.; H. J. Rahilly, superintendent, Mine Fire & Hydraulic Filling Dept., Anaconda Copper Mining Company, Butte, Mont.

WILLIAM CONNIBEAR
Chairman

MINE ACCOUNTING

This is a new section, and its personnel is but just completed. However, in spite of the limited time for the preparation of a report, Mr. McGrath, one of the foremost authorities on metal mine accounting, will render an especially well prepared report and will outline practical plans for the future work. The personnel of the committee is one to inspire confidence, and is composed of the following well-known authorities:

T. O. MCGRATH
Chairman

L. S Cates, general manager, Utah Copper Company, Salt Lake City; J. C. Dick, Salt Lake City; H. H. Miller, general auditor, Hercules Mining Company, Wallace, Idaho; H. L. Norton, Phelps Corporation, Douglas, Arizona; Harry Vivian, chief engineer Calumet and Hecla Mining Company, Calumet, Michigan.

MINE VENTILATION

Mr. Mitke has been conducting the work of this section. Considerable investigation has been made along the original lines outlined, of investigating various types of ventilating equipment, and standardizing of blowers and ventilating pipe, etc., and a comprehensive report is being prepared. This section includes among its members some of the best authorities on mine ventilating in the country and its recommendations are received with interest. The personnel is as follows:

A. C. Stoddard, chief engineer, Inspiration Cons. Copper Co., Inspiration, Ariz.; D. Harrington, Bureau of Mines, Golden, Colo.; Norman G. Hardy, chief mechanical engineer, Smelter Dept.,

Arizona Copper Co., Clifton, Ariz.; W. A. Rowe, chief engineer, American Blower Co., Detroit, Mich.; E. B. Williams, manager mine fan department, B. F. Sturtevant Company, Hyde Park, Boston; Robert N. Bell, state mine inspector, Boise, Idaho; F. L. Stone, General Electric Co., Schenectady, N. Y.; C. E. Legrand, consulting engineer, Phelps Dodge Corp., Douglas, Ariz.; O. K. Dyer, Buffalo, Forge Company, Buffalo; Don M. Rait, assistant superintendent of mines, Calumet and Arizona Mining Co., Warren, Ariz.; A. S. Richardson, chief of ventilating department, Anaconda Copper Mining Co., Butte, Mont.

IV. Conference Program

A JOINT SESSION of the two branches of the Standardization Division will be held in the forenoon of Monday, October 17. This will be an informal conference, intended largely for getting the members and guests of the Standardization Division acquainted. At this meeting there will be appointed a committee to receive and review all reports from both branches, with the object of correlating the work and getting reports in uniform style for presentation to the conference. Separate sessions of the coal and metal branches will be held in the afternoon. The chairmen of the two branches will present their reports, which will be followed by presentation of reports of the chairmen of the various sections. These reports will be discussed and, if necessary, referred to the Joint Special Committee for final consideration before being presented to the conference for adoption. Members of the conference are cordially invited to attend the formal opening of the National Exposition of Mines and Mining Equipment, at the Coliseum, on Monday evening.

Tuesday, October 18—A program of special interest to the Standardization Conference will be given by the convention management at the Coliseum in the morning, and delegates are urged to attend. In the afternoon separate sessions of the two branches will be held and the discussion of reports will be continued. A special program for all convention delegates will be given at the Coliseum Tuesday evening.

Wednesday, October 19—A Joint session of the metal and coal mining branches will be held in the forenoon and the program will consist of addressses on subjects of particular interest to this conference. Men of national importance will address this session. In the afternoon final separate sessions of the two branches will be held, and final discussion of reports will take place preparatory to their presentation to the joint session Wednesday evening.

Thursday, October 20—The Standardization conference will attend the general convention at the Coliseum in the forenoon, and in the afternoon a joint session of the two branches will be held, and the program will cover Standardization, both national and international. The convention management has arranged to give this evening entirely to the Standardization conference and an unusual program has been arranged, including addresses by Herbert Hoover and other speakers of national and international importance. Final reports and resolutions for adoption by the convention will be presented.

Friday, October 21—Members of the Standardization conference will attend the convention at the Coliseum in the morning and in the afternoon, as a body, they will inspect the demonstrations of mining machinery and equipment at the National Exposition to be held in conjunction with the convention. In the evening the annual banquet of the convention will be held.

Saturday, October 22—Members will attend the general sessions of the convention at the Coliseum in the morning. The convention management has arranged special entertainment for the delegates in the afternoon. A special feature entertainment will be given at the Coliseum for all delegates Saturday evening, and all members of the Standardization conference are urged to attend. All joint and separate sessions of the coal and metal branches will be held at the Congress Hotel, the convention headquarters.

STATE TAXATION OF MINES TO BE CONFERENCE TOPIC

IN ADDITION to bearing the annual bill of the federal government of approximately $4,000,000,000, the taxpayers of the nation are supporting state, county, city and town governments—a burden even greater than that imposed by federal requirements. The American Mining Congress has devoted much time and attention to federal taxation with results which, it is beliieved, have been highly beneficial to the mining industry. Problems of state taxation, however, while important, have not been the subject of serious general consideration until recent years.

The local systems of taxation of particular states have not commanded the attention of the mining industry as a whole, but it is now recognized by leading authorities on mine taxation that the lack of uniformity in state laws, unscientific and varying methods of valuation and assessment, and the adoption of new methods of obtaining revenues by state and local authorities without due consideration to the relation and effect of such methods upon the industries of the state as compared with similar and competing industries of other states, and without relative consideration of the tax burden as a whole, and also the imposition in many instances of a high rate of tax upon a particular industry because of prejudice or discrimination against or indifference toward non-resident owners and stockholders, have resulted in an enormous tax burden which does not spread equitably over every unit of the mining industry, and a situation where properties in different states can not be operated on equal terms.

Believing that a thorough discussion of "state taxation of mines," (1) existing laws in various mining states (2) principles and (3) uniformity, by representatives of state governments and representatives of the wasting industries will serve a useful purpose, this subject has been selected by the Committee on Taxation of which Paul Armitage, New York, is chairman, for consideration at the Mine Tax Conference to be held under the auspices of the American Mining Congress at its coming convention in Chicago. Invitations have been sent to the governors of all the states to appoint special delegates to attend this conference, and the conference is open to all others interested in mine taxation who desire to attend. Members of the American Mining Congress are urged to take up with the governors of the states in which they operate the matter of having delegates appointed for this conference which has for its primary aim the discussion and refinement of methods which will equalize, simplify, and lighten the growing tax burden, and thus stimulate industry.

SOME PROBLEMS FOR COPPER AND BRASS

By Walter Douglas
President, Phelps Dodge Corporation

WHEN A COUNTRY GOES TO WAR, the responsibilities of the moment fall as heavily on its industries as they do on its individuals. Just as a nation must rapidly mobilize its man power in such crises, so also it must, without delay, mobilize its industrial resources. In the battles that follow, the two forces fight side by side.

As millions of men scurry from all directions toward the training camps to take their places with the colors, the spirit of patriotism becomes rampant, and there is little time or thought for that even more important although silent gathering of the country's industrial resources, without which armies would be helpless.

As men come maimed and wrecked out of war, so not infrequently do industries emerge with their foundations shattered, their prestige gone, their places taken by others. As wounded and broken men must reconstruct, so must industries, laid prostrate by war, rehabilitate themselves when peace dawns and normal conditions return.

Neither individuals nor industries ever gain much for themselves by attempting to throw the burden of their reconstruction back onto their governments. In the first place government will not assume it; in the second place it has the savor of capitalizing war services. The job ahead of many American industries is not to look to Washington to cure the ills of the war years, but to get out on their own and hustle.

Naturally I have copper and its affiliated industries in mind in recording these few thoughts. I doubt if any of the country's industrial bulwarks got so complete a scorching out of the World War. When nations decide to annihilate each other copper assumes an even greater importance than gold. You might, probably could, kill a man with gold but it would not be easy; you simply cannot kill a man in a scientific, up-to-date manner without copper. As a facetious writer once said: "The nation that goes to war without a good stock of copper is worse off than it would be without a Board of Strategy."

WALTER DOUGLAS

When Germany embarked on the war which ultimately set the whole world ablaze, about the first thing she did after mobilizing her armies was to gather up every scrap of copper, brass and bronze in the empire. Not only were the treasures of museums seized and public statues torn from their pedestals to be thrown in the crucibles, locomotives stripped of their copper fire boxes and tubes but the kitchens of the humblest homes were raped, and the treasured pots and kettles of the housewives were seized in the national interest. Why did Germany do this? Because Germany is not what we would commonly call a copper producing country. The Germans knew that without copper they soon would be helpless. They knew too that blockade would shut off all outside supply, and so they lost no time in mobilizing every ounce of the red metal that they could lay their hands on.

When the United States entered the war its first demand, almost, was on the copper and brass industries. Overnight the great producing organizations of the American copper companies were enlisted in the national service. Under intensive pressure the mines of Michigan, Montana and Arizona began to pour forth their heavily weighted ore, the smelters and refineries established new records for output, the rolling mills went on a twenty-four hour a day working basis, and there started into the ammunition factories of the country a flow of copper, brass and bronze sheets, tubes and rods such as the country had never witnessed before, and in all likelihood never will see again.

In a few weeks, the great copper and brass industries of the United States enlisted themselves in war service, supplying not only this country, but the rest of the world with a large proportion of its supply of the precious red and yellow metals. This service copper and brass rendered to the very end, as they will again if the need ever arises.

Those who are perplexed over the present plight of copper and its alloys must remember that an industry fundamentally commercial in character, cannot run away from home and go to war without sustaining some hurts. Not that copper was without previous war experience, for it had plenty and it profited greatly by it. Copper did its bit in the Spanish-American war, in the Boer war, the Russo-Japanese war and in the Balkan wars, and it gained not only by the demand created by these wars, but by the apprehension which these wars caused in all countries, spurring them to abnormal measures of preparedness, in which copper and brass played a very large part.

But in all this American copper found no reason to abandon in the slightest degree its commercial position. It could take care of a dozen such wars and never relinquish its foothold as one of the chief metals of commerce. But when America went to war things were different. Ordinary considerations of business were thrust aside. Our country was menaced and its every resource instantly placed at the disposal of the federal government. Every ounce of copper that could be produced was needed for the war service of our country and its Allies. Every facility of the great brass and copper fabricating plants was put to its maximum speed. And overnight two of the country's greatest industries were metamorphosed from producers of essentials of peace into producers of essentials of war.

I sometimes wonder how many people understand the fields which copper and brass abandoned in a few hours in order to do its part in war service. In a score of

industries representing an annual consumption of copper and copper alloys running into hundreds of millions of pounds, an almost disastrous condition was created. There was no copper for them. The government needed it all and none was disposed to question its right to all that could be produced.

Now a country may be in a war and yet physically untouched by that war. Where this is the case, as it was with the United States in the World War, ordinary industry goes on, the demand for the usual materials of commerce continues with only slight curtailment. Therefore, when copper, brass, bronze and other copper alloys joined the colors, industry demanded something to take their places. And here is where a flood of substitutes was turned loose to provide the building, roofing, plumbing, hardware and other industries with the means of continuing operations.

It is in no spirit of criticism that I mention the intensive campaigns of other metals and materials to seize and entrench themselves in the positions always held by copper and copper products. It was good business from their point of view and they took full advantage of the situation. But I say unreservedly that it is not good business to continue the use of substitutes for copper and copper products in the fields where they are pre-eminent, now that copper is plentiful.

It may be good business from the standpoint of a plumber to use a substitute for brass pipe for hot water supply, because he knows that in time he will have to replace that pipe. It may be good business for a hardware dealer to sell brass-coated steel screws, because there is more profit for him in them than in solid brass screws. It may even be good business for a roofer to lay a tin roof that requires constant upkeep expense, and replacement every few years, instead of a copper roof, the life of which when properly laid is everlasting. But none of these things is good business for the consumer. The slightly higher initial cost of copper, brass and copper products generally, would not deter their use where the ultimate saving accomplished by them was understood.

Of course there are many basic industries in which copper must be used. Electricity is one of these. But in the last twenty-five years the copper industry has made tremendous strides in many directions. Today it is one of the chief sources of the nation's wealth. Europe today is clamoring for American copper, but Europe hasn't the money to pay for all the copper it wants, and our industry, like many others, is suffering from a heavy curtailment of its export business, which will continue until Europe finds some way to finance itself.

Hundreds of millions of good American dollars are invested in the copper and brass industries. Great plants have been reared. It is of national importance that these huge investments be kept busy, and pending the adjustment of Europe's economic difficulties, they must depend in large measure on domestic consumption. Some idea of the enormous growth of the copper industry may be gathered from the fact that while in 1895 the smelter output from domestic ores was, roughly speaking, 380,000,000 pounds, by 1916 it had jumped to 1,928,000,000 pounds, and in 1918, under pressure of war needs, reached approximately 2,500,000,000 pounds. Also the importance of the United States as a copper producing country may be gauged from the fact that while in 1895 the mine output of copper represented 51.5 percent of the world's supply, between 1916 and 1918 it was 62 percent and in 1919 it ran between 55 and 60 percent.

Of course no such tremendous increase of production could have been brought about on the basis of demand alone. But demand, particularly that created by the growth of the electrical industry, stimulated advances in the metallurgical and mining arts, making it possible to work low grade ores, which twenty-five years ago could not have been taken from the ground with any prospect of profit.

A frequently voiced criticism of the copper producing industry is that it has not always followed its product through; that having mined, smelted, refined and sold copper, it has paid little or no further attention to it. However true this may have been, it no longer is the case. The copper producer today is vitally concerned in the destiny of the metal after it leaves his hands. It is just as important to him to check up the consumption of copper, brass and other copper alloys in the thousand and one forms that they reach the ultimate consumer, as it is to the fabricator, to the manufacturer or "cutter" of the metals, or to the jobbers and retailers.

If copper, brass and bronze articles either of utility or ornamentation are being held by retailers at prices that are prohibitive, compared to similar articles of other metals or materials, one outlet for the copper flow is clogged, and that surely is a matter of concern to the copper mining interests. The same argument applies to copper and copper products in other fields. It has been said that in small articles copper and brass pass through too many hands, resulting in an abnormal price to the consumer. If this is the case it must be corrected, will, I am sure, be corrected before the co-operative effort now under way to stimulate the use of copper products has progressed very far.

My reference to small articles of copper and brass may be considered by some as trivial, considering the vast quantities of the metals that are used in building, electricity, ships, etc. But when we list the hundreds of different articles into which copper finds its way, either as copper, brass or bronze, we find that each one accounts for a very large annual consumption of metal. Take pins for instance. As far back as 1914, the pin industry alone absorbed something like a million and a half pounds of copper a year. Today I believe it accounts for more than two million pounds. Add to the consumption in pins, the consumption in hinges, in door knobs, in key hole protectors, in drawer handles and in scores of other small articles both useful and ornamental, and you get a staggering total. In a period when American industries are forced to do all in their power to stimulate their home markets, it would be crass folly to ignore such things.

If the miner of copper and the fabricator of copper and brass are to "follow through," it must be by co-operative effort. There has unfortunately been too little of this in the past. Through the Copper and Brass Research Association, which recently was formed, there has been brought about a cohesion of the producing and fabricating interests, which we feel sure will in time include the manufacturers of articles of copper and its alloys, the jobbers in copper products and indirectly those retailers, large and small, who deal directly with the ultimate consumer.

We who know copper feel that it is the peer of all commercial metals, that it has qualities not possessed by other metals and that through sheer merit it will in time find its way back to the many fields it occupied before the war.

What other metal is so easily worked? What other metal has such resistance to corrosion? What other metal gives such service or has such long life? What other metal has such a salvage value? What other metal is comparable to it in beauty?

Architects know all these things about copper. So do builders, and plumbers, too, as a rule. Also they know that in building enterprises copper and brass, while perhaps slightly increasing a budget at the outset, work an ultimate saving to the investor. In a recent number of the *Mining and Scientific Press* I read an article, the writer of which somewhat cynically asserts that "what

the copper industry needs is an alarm clock," in which this statement is made:

"No well informed person questions the superiority of copper and brass for a great many of the uses for which substitutes are now being employed; the manufacturers of automobiles know this and the architects and builders know it."

All of this being true, which it doubtless is, we of the copper and brass industries are forced to the conclusion that one of our neglects of the past has been public education; failure to enlighten the ultimate consumer. And so among other things we have embarked on a campaign of education, the details of which are being directed by the newly formed Association in connection with its work of technical research.

Briefly expressed the task before us is to protect copper and copper products in those industries like electricity, where they already are firmly entrenched, to rehabilitate them in industries where they have been partially supplanted by substitutes as a result of the war, and to be constantly on the alert for new uses for the metal and its alloys.

I have purposely refrained from burdening this article with statistics of copper production and copper prices, and I have avoided technical terms and references, believing that the problems of copper just now have to do with plain, every-day, common-sense methods of stimulating sales in the domestic market. We want to sell more copper and brass. We can only accomplish this by getting the people to buy more of our products. They will only increase their purchases if they are convinced that it is to their advantage and profit to do so, and our job is to show them that it is.

This we purpose doing in part by educational methods, and we feel that we are particularly fortunately placed in that in exploiting the merits of copper and brass we need never resort to exaggeration or misstatement Copper and copper products will live up to everyting that can be claimed for them.

As the Copper and Brass Research Association only recently was formed, I should like to direct attention to one of its very important functions which should be of interest to your readers. That is its general information service. Whether a man buys but a package of screws a month from his hardware dealer, or puts up a forty story office building every year, the Association is prepared to show him why he should use copper and copper products. All information, technical or general, concerning the metals can be obtained at the offices of the Association, No. 25 Broadway, New York City, and persons with problems on their mind, who cannot get to New York, are welcome to write their inquiries.

SALT LAKE TO ADVERTISE UTAH'S MINING RESOURCES

Fifty thousand folders telling of Utah's mineral wealth and the development opportunities which they present will be prepared and distributed by the Salt Lake Commercial Club and Chamber of Commerce. The mines are the source of 65 percent of Utah's wealth. Material for the folder has been gathered by the mining committee of the club and statistics by Thomas Varley of the United States Bureau of Mines. Copies will be sent for distribution at the coming Mining Congress convention in Chicago. The folder will also be distributed at the Utah state fair.

As planned by members of the mining committee, the booklet will present a complete epitome of the development of the industry, both mining and smelting, from 1865 to the present time. The statistics will cover production and the booklet will also include maps and graphic representations of some of Utah's mines.

COLORADO MINE LEADER ELECTED TO RAILROAD DIRECTORATE

BULKELEY WELLS, former president of the American Mining Congress, has been elected a member of the board of directors of the Denver & Rio Grande Western Railroad. Mr. Wells is the first Colorado business man not connected with the railroad in any way who has been elected to its board for the last thirty years, and his election is taken as an augury that the railroad will work hand in hand with the mine operators for the development of Colorado.

Following the election of Mr. Wells, president J. H. Young of the railroad gave out an interview in which he said:

"Mining is the industry that inspired the building of the Denver & Rio Grande, but, unfortunately, that business has had a long period of depression. It must be revived as far as possible. General Wells, as former president of the American Mining Congress and in his public and private business activities, has acquired a knowledge of mining and its needs which will enable him to make valuable suggestions.

"Colorado and the Denver & Rio Grande Western are largely dependent upon agriculture and irrigation incident thereto. General Wells has large personal interests in irrigation, and is acquainted with the needs of the agricultural industry. The general business of Colorado is a reflection of the efficiency of its transportation facilities. No man in the state has broader views or is more progressive than General Wells. It is a matter of personal gratification to me that Colorado has representation on the board and that so able a man has been chosen."

COAL LEADS WATER AS PRODUCER OF ELECTRIC POWER

PRELIMINARY REPORTS issued by the Geological Survey on consumption of fuel and production of power by public utilities plants by states during February, March, April, May and June, 1921, show that the increase in power output during these months of 1921 as compared with the corresponding period of 1919 was furnished by fuel consumption, the amount of water power produced being nearly the same in both years. The number of tons of coal consumed in power creation during each of these five months was, in their order, as follows: 2,629,563; 2,641,588; 2,416,579; 2,415,263; and 2,437,457. Corresponding figures for fuel oil consumption, given in terms of barrels are: 781,436; 848,866; 843,193; 853,380; and 918,958. The monthly consumption of natural gas, given in terms of thousands of cubic feet, was: 1,464,682; 1,543,664; 1,853,783; 1,994,126; and 2,064,024. The total power produced by these fuels each month is reported as the following number of thousands of kilowatt hours: 3,166,041; 3,394,987; 3,239,471; 3,269,060; and 3,236,809.

NO CUT IN APPROPRIATIONS FOR MINING BUREAUS

NEITHER the Bureau of Mines nor the Geological Survey will be seriously affected, either this year or next, by the cutting of budgets which has become so prevalent in Washington, according to present expectations. Each bureau is being operated so efficiently that no diminution of expected expenditures could be made without injury to the service.

Judge E. C. Finney, Assistant Secretary of Interior, is understood to have recommended increased appropriations for both the Bureau of Mines and the Geological Survey, especially for topographical surveys, research work on non-metals and shale and for publication of mineral resource information.

IRON ORE

By Dwight E. Woodbridge, E. M.

THE IRON ORE INDUSTRY is just now in the depths of the most severe depression it has known since it became important in America. Never has there been a year since statistics were first gathered in this country when the decline of a season has approximated the percentage that 1921 bids fair to show. But these doleful periods come and go, and each returning tide sets a higher mark than those before it. So, while the high point made in 1916 was due to conditions unlikely to recur, iron miners are not downhearted for the long pull, and they look for a material improvement in the coming year.

Nineteen sixteen was the record making year in iron ore; in that year the country produced 77,870,000 tons (of 2240 lbs. each) of iron ore., valued by the U. S. Geological Survey at $182,000,000. In that year twenty-four states contributed to the total. To make that total Minnesota led, and following it were Michigan and Alabama, a ranking that has not changed for a long time and that probably will continue for many years.

The distribution of iron ores throughout the United States is very general; more so than that of any other metallic mineral. There are but four states in which these ores are not found in considerable quantity. But not all known deposits are available for use at present. Some contain too little iron for direct smelting and others carry deleterious elements such as sulphur, phosphorus, titanium, silex, etc., in prohibitive quantities. Some deposits that are suitable in other respects are so far from manufacturing centers that transportation costs are excessive. Some deposits lie in scattered beds or in narrow veins or lenses. Still others, though they may be near centers of manufacture and are perfectly adapted for use, contain elements that make them undesirable for the iron or steel requirements of the particular region in which they occur.

DWIGHT E. WOODRIDGE, E. M.

As the value of iron is small when compared with that of the other leading metals, transportation costs govern the value of its ore much more absolutely than they do that of many other minerals. Charges for transportation, cost of mining, and character and quality of ore determine the worth of an iron ore mine. In other words, value is based on three main factors, location with regard to markets, mode of occurrence, and chemical and physical composition. Subordinate to these factors are others that may be regarded as of local importance. An ore low in iron content may be available because of cheap transportation, easy mining, adaptability for beneficiation or worth in metallurgy, while a far richer ore may wait indefinitely for exploitation.

Evidence of the interdependence of these factors is easily had. For example, the ores of southwestern Utah remain untouched. They are of high grade and are in quantity, minable from surface openings and with no expensive equipment or preparation, but mountain ranges and great distances intervene between them and any present markets. The ores of the Sierras of California are somewhat similarly placed. On the other hand the fossil red ores of Alabama, though they are low grade, carrying from 35 to 37 percent in iron, form beds of great lateral extent and suitable thicknesses, contain enough lime to be self-fluxing and lie near beds of coking coal. So they are mined to the limit of the demand for the iron and steel to be made from them. Similar illustrations may be seen in many parts of the world and in almost every iron region of the United States. The supply of brown ores in the southern states undoubtedly is vast and their mining is not difficult, yet the consumption of these is but a fraction of what it was forty years ago, although the iron and steel requirements of the nation have increased ten fold. Billions of tons of rich ores exist in the interior of Brazil, but the cost of transportation, the lack of fuel, and the absence of markets restrains their development. Ores of 50 percent iron lie under the sea on the coast of Newfoundland, but as transportation is cheap they are mined many thousands of feet beyond shore line. Hydrated soft ores along the coast of Cuba are easily mined and are convenient to the sea, but their moisture content and the cost of drying and handling keep them from as wide use as might seem logical.

Another controlling factor, one of a group that may be classed as of secondary importance, is that of allied industries. A study of freight rates on iron and steel from the great centers of manufacture in Birmingham, Chicago, and Pittsburgh shows that the country divides itself, along lines of practically neutral freights, into three areas that contain somewhat similar proportions of the total population of the United States, but that of Birmingham includes the negro element and is chiefly agricultural and its buying power is far less than that of Chicago, which is in turn less than that of Pittsburgh, in which latter arena are grouped the great fabricating centers. The area tributary to Birmingham lacks that diversity of manufactures that has made Pittsburgh such a center for steel. So the ore reserves of Birmingham are drawn upon but slowly in comparison with those which feed Chicago and Pittsburgh.

The ores of the Lake Superior region, although more than a thousand miles from the furnaces in which most of them are reduced, are so cheaply transported, so easily mined, and are of such quality that they furnish about 85 percent of the total of the United States. This fact calls attention to the factor of transportation facilities. Were the mines separated from their furnaces by 1,000 miles of rail haul they could not have attained the leadership which they hold. Their rank attests the importance of the highway of the great lakes. That free and competitive right of way extending from Duluth to Lake Erie ports, improved at great expense by the government for the carriage

of large cargoes, has counteracted the disadvantage of mere distance.

Some of the magnetic ores of northern New York state are of low grade and some contain elements more or less deleterious, but they are so near furnaces and so amenable to beneficiation, or treatment that frees the iron oxide from its worthless gangue, that they are produced in quantity.

The iron industry of the United States is subject to certain permanent disadvantages as compared with that of leading producing countries of Europe. One of these is the fact that raw materials of production are, in general, so remote from each other that the cost of assemblage is much higher than in other iron making countries. In great Britain rail and water hauls are but short, and coal, ore and flux are easily brought together, and the manufactured article need be taken but a few miles to some convenient outport or consuming center. Somewhat similar conditions exist in France, Germany and Belgium. In the United States long distances may separate the ore and the fuel, whereas in England it is difficult to find an iron producing locality where ore and coal are more than a hundred miles apart. The average length of haul for all iron ore used in the United States is about 700 miles and for coke with which to smelt this, 300 miles. In Europe, when it is necessary to bring raw materials from one country to another, as in moving the ores of Spain or Sweden to England or Germany, the cost usually is low, both because of short distances and water haul.

In this country the cost of transport also tends to impede the ready distribution of products. These must often be carried long distances in their search for markets. The nation is of vast extent, and the industries that consume iron are in every part of it. Railroads are the principal means of communication between producers and consumers of steel in the United States. Heavy products can be carried from Liverpool to our Gulf ports more cheaply than from our own mills not situated on the sea or on the Mississippi river.

But the disadvantages have been largely overcome by the ingenuity of American engineers. Marvelous efficiency has been developed on the great lakes, and most powerful machines are used for handling the ore on land. Sometimes scarcely a human hand touches iron ore from the time it leaves the bed in which nature deposited it until it passes out of existence in the blast furnace, even though its journey may require not only mining but eight or ten transshipments. The nation owes more than is realized to those whose efforts have been bent to the improvement of the inland waters of the great lakes and their connecting channels.

300-TON SHOVEL MOVING ORE

Mesabi Range. Shovel is three times as powerful as those used in digging the Panama Canal

For many years there has been a gradual decrease in the amount of metallic iron included in the average hematite iron ores mined in the United States. This has given rise to fears for the comparatively early exhaustion of ores of that nature, or that their grade would be so reduced that the country could not maintain its place in the trade of the world. Such fears, while not without foundation, are yet a long ways from justification. The diminution in production of those ores suitable for the manufacture of bessemer steel, by the usual acid method, is a matter of more immediate importance, and the growing scarcity of bessemer hematite ores in districts where they are of use has led to a change in American steel making. Statistics of the Lake Superior ore trade for the past two decades show this gradual decrease in iron content of ores and the still more remarkable drop in percentage of bessemer ores in the district from which has been wont to come almost all the bessemer ores of the United States. These statistics show; first, that the proportion of bessemer in total shipments has dropped in twenty years from 64.9 percent to 32 percent, second, that the percentage of iron in this portion of the total has gone from 57.13 percent to 53.9 percent, and third, that the percentage of phosphorus has risen from .040 percent to .044 percent, or to the theoretical maximum for a bessemer ore; the significance of these facts lies not alone in the diminution of the proportion of bessemer to total ore, but also in the lowering of grade of the quantity shipped and in the rise of the percentage of phosphorus to the permissible limit for bessemer ores. It is well known that the so-called "bessemer' ore is one whose phosphorus content is so slight that the manufactured iron shall not contain more than 0.10 percent of it, and the ore must carry so little that the sum of phosphorus in all the ingredients of bessemer iron manufacture shall not exceed this percentage. Certain other minor elements are also limited by the bessemer maker, but these need not be enumerated here.

UNLOADING IRON ORE ON THE LAKES

Showing movable bridges for handling ore from stock, also cantilever extension from unloading machine dropping ore into stock. Ship on right, furnaces on left.

The most significant development that has taken place in iron ores during recent years is that which has brought into availability vast stores of the hard, lean, magnetic iron rock of northern Minnesota. For the reason that now some $4,000,000 are being put into a works for making high grade iron ore out of this material, it is attracting especial attention and causing much comment. There is nothing new in the idea of beneficiating lean magnetites; this work has been done for generations both in this

country and abroad. Operations of the sort in the Adirondacks and in Sweden and Norway are well known. But there seems to be something almost revolutionary in applying to a very hard and lean magnetic rock, in which the crystals of magnetite are excessively minute, the principles of concentration that have been worked out in disseminated copper porphyries of the west: and applying these principles in such a way that the financial successes made in copper—which sells by the pound—are sure to be made in iron—which sells by the ton.

As the immediate of the experiments that justified this initial expenditure of $4,000,000 many hundred million tons of high grade, bessemer, ores are added to the reserves of Minnesota. As the indirect result it is hard to foresee to what far off horizon of the future may be relegated the exhaustion of Lake Superior iron ores.

The company that is making this investment has ambitious plans; it expects to continue and expand its construction until, when demand requires, it may be in position to supply 30,000 or 40,000 tons of concentrates per day, from mills two or three times as large as any now in existence. Even with such a draft upon them, its reserves are sufficient for generations.

There exist in the Lake Superior region assured and probable ores to a total of nearly three thousand million tons, of which nearly half come under the class of assured ores. These figures include commercial grades only, together with a conservative estimate of the concentrates to be derived from those ores owned by the company above referred to, and definitely known by it to be concentrable. The total does not take into consideration the vaster tonnages of iron bearing material, as estimated by the U. S. Geological Survey. Of this total more than half, or 1,635,000,000 tons, is on the Mesabi range in Minnesota, and more than two-thirds, or 2,139,000,000 tons, in Minnesota as a whole. The rest, with exception of some 77,000,000 tons in various Wisconsin areas, is in Michigan. In addition to the grand total as above, there are iron rocks on the Canadian side the lake, mostly low grade and requiring concentration, but probably in no such quantity as those south of the international boundary.

For the past few years the annual average consumption of Lake ores has been sixty or sixty five million tons, and during the seventy years in which the Lake Superior region has been a factor in the trade, shipments have doubled every seven years, on the average. Should they continue to double, even in four times seven years, that twenty-eight years would see almost their exhaustion. But in point of fact production cannot continue increasing decade after decade; long before the end there comes a time when it must decline. The mere physical difficulties inherent to the business of mining ore will attend to that. It is questionable how near the region has come, now, to its maximum. Many predict that the summit of the curve is almost at hand, and that there will begin soon a long and comparatively slow decline.

Where, when that time comes, will the ore be won for our industrial maintenance? There are the tremendous reserves of red ores in the Birmingham region; the probably great but uncertain quantites of brown ores in the states of Alabama, Georgia, Tennessee, Missouri and Texas; the magnetites of the Adirondacks and the red ores of other New York counties lying along Lake Ontario; the ores of New Jersey and the highlands of the Hudson river; the deposits of southwestern Utah and southern California, and the sporadic occurrences of the Pacific coast, and the intermountain states, the banks of Cornwall and the possibilities of the Blue Ridge.

As to any or all of these regions questions rise concerning transportation, tonnages available, and adaptability of the ore of a particular district to the requirements of manufacturing centers that it can reach.

The economic limitations of the Birmingham zone have been suggested above; they are emphasized by the fact that this area produces only about a tenth as much ore as does Lake Superior, although its reserves are nearly half as great and its furnaces and mills are at the very portals of its mines of both ore and coal. These red ores extend to a considerable distance both north and south from Birmingham and are mined in Georgia and Tennessee. While their iron content is not high they are comparatively dry and they carry some lime, so that the disadvantage of quality is more apparent than real.

Brown ores, or limonites, are widely distributed in several southern states. In Texas they appear repeatedly within an area of 20,000 square miles. Residual deposits occur in Missouri more or less frequently throughout an area of perhaps a quarter of the state; in Alabama they are to be found occasionally over 7,000 square miles. Sometimes they are very thin, and not always are they good enough to smelt until they have been washed free from clay and soil, in intimate admixture with which they often occur. On account of the difficulty of estimating tonnages no proper recognition has been given these ores. In my opinion their quantities may far exceed any official estimate ever made. But their use is now limited, to only 2.6 percent of the total of all ores. This is for two reasons; first furnacemen prefer others ores, and second they prevail in regions where demand for any ores is not great—as in Missouri or Texas—or where more satisfactory ores exist in quantities ample for all needs—as near Birmingham. Inconsiderable quantities exist in many Atlantic states. It is an interesting and suggestive fact that in Maryland, where there are six blast furnaces, seventy years ago there were 31, whose total iron making capacity was as great as the six can make in five weeks. And all those old stacks, whose ruins dot the state, used local brown ores; but all the iron now made there is from foreign ore, mined 1,000 miles away on the shores of the Caribbean sea.

In New York and New Jersey there may be a quantity of magnetic ore approximating the tonnages on Lake Superior, most of it lean and some of a character making it difficult to maintain grades. On account of the backwardness of the development of the steel business in that section these are mined to a very limited extent. Sometime the East will waken to its possibilities and then these reserves will be valuable. The same is true of the red ores of the Clinton region of New York, where five hundred million tons of available material lies buried. It is strange that the East should import from Spain and Sweden when a few miles from New York City and Philadelphia there are abundant stores of the same material. Utah and California, the north Pacific coast and the intermountain region are far from markets and will so remain until there are revolutionary changes in the steel industry. Their ores can never be available for the great iron making centers of today.

The future must depend on leaner ores and an extension of the science of beneficiation before smelting. It is in in this that lies the real significance of the present preparations for concentration on the Mesabi range. Of these leaner ores, rich enough to treat economically, there is an enormous but incalculable supply.

At our doors lie vast reserves which trifling economic or transportation changes will bring to us in increasing quantities—Newfoundland, Cuba, Chile and Brazil, and the possibilities in Hudson Bay and Ungava land. The nation must rely on its own leaner ores unless it is willing, in time to come, to forfeit its predominance in mining. Undoubtedly importation will grow, but they need not be a controlling factor now that the problem of concentration has been solved successfully at home.

MANGANESE

By Chas. W. Potts

TIME WAS, not long ago, when but few people had ever heard the word "manganese." It might have meant anything from an elusive germ to the trade name of lingerie. A few remembered it as a chemical element, and some associated it with antiseptics or blood tonics.

Immediately previous to our entrance into the world's war that word "manganese" was flashed across the wires of the country. It appeared in headlines over startling announcements in the daily papers. "Government geologists and metallurgists said that if America should become involved in the European struggle we could get along without, or supply all of our needs, so far as raw products were concerned, from our own resources with the exception of manganese." But of manganese we had no known reserves of importance, and manganese was of utmost importance in steel making.

CHAS. W. POTTS

As the name appeared more frequently in print its relation to iron and steel became fixed, but many people got the idea, as there are a few who still think, that it is the name of some special kind of iron ore.

Then the terrible thing happened. We did get into the war. The two most important things required to win that war were men and munitions. Munitions meant steel; steel required manganese. Nobody knew we had any deposits of manganese worth mentioning, but the steel industry said get it, and the patriotic War Boards got busy in the latter part of 1917 and as a result of their activities, manganese was unearthed from American deposits in such quantities that the market was overstocked with the ore and the alloys in the latter part of 1918. The public learned that manganese is not a form of iron ore, but that it is another metal. It is used in steel making but it is just as different from iron as lead is from zinc. There is still in the popular mind much confusion about its characteristics and its uses. This article will attempt to explain some of the technically interesting things about manganese in a way that will not be technical.

Manganese is a metal; it is about as heavy as iron; its specific gravity varies a little but averages 7.42. It has about the same melting point as pig iron. It looks, when new and unoxidized, like the freshly broken surface of cast iron, it is a greyish-white, but it has a slightly reddish luster that iron does not have. If you examine it before it is changed by exposure you will find it is about as hard as iron but is so brittle that it is easily crushed to small particles with a pair of forceps.

If you had some fragments of pure manganese metal and would leave them exposed to the air to examine later, you might think someone had played a practical joke on you when you should come look at them for they would be gone and in its place would be little piles of fine black powder. This powder would be manganese dioxide. The metal would have crumbled, taken on oxygen from the air, in other words, it would have oxidized, gone back into a chemical form quite similar to the form in which it existed as an ore. It is so unstable when pure that it will not long remain in a metallic state unless submerged under oil or kept confined in a receptacle where air will not reach it.

Manganese has so great an affinity for oxygen that it will decompose warm water with the evolution of hydrogen, in other words it will apparently dissolve in water leaving a black, inky sediment. Manganese also has a great affinity for sulphur; it has a greater affinity for both oxygen and sulphur than has iron and therein lies some of its chief advantages in steel making.

Versatility of Manganese in Steel Making

Now, everybody knows that steel is refined iron and to make steel the iron has to be melted. The manner in which the iron is melted has a great deal to do with refining it. Steel is ordinarily made in either a Bessemer converter or an open hearth furnace. In either of these processes certain elements that are deleterious to steel are burned out, but in the burning out of the deleterious elements there is also burned out too much carbon. A certain amount of carbon is needed to give steels certain desirable qualities. It is in this process of improving the quality of the common steel where manganese becomes so useful. It takes up the oxygen that has united with the iron of the steel and this chemical reaction is called deoxidizing the steel; it takes up the sulphur that got into the steel from the coke or from the original pig iron and this is called desulphurizing the steel. The adding of the manganese in the form of a crude manganese alloy replaces some of the carbon that has burned out; this is called recarburization. Besides the deoxidation and the desulphurization and the recarburization of the steel, manganese also greatly improves its quality by giving the steel ingots a more desirable texture, making possible the rolling and shaping without the formation of excessive fissures or surface defects. No other alloy can take the place of steel for improving its quality to the extent that manganese accomplishes this result. Manganese in increasing amounts raises the saturization point of iron for carbon. "Manganese is the best tonic for steel," is an old adage that still finds favor.

The use of manganese in steel manufacture started in 1839 for improving malleable iron and cast steel. No steel is made today without manganese; next to iron and carbon it is the most important constituent in steel making, yet in ordinary steel it exists in only from .30 percent to 1.00 percent. Contrary to the popular belief, its chief use in the steel industry is not as a hardener of special

steel but as a reagent; for purging common steel of certain deleterious substances and carrying back into steel one necessary element, carbon.

While manganese in quantities less than 1 percent improves the rolling and forging qualities of steel, if the manganese is increased from 1½ percent up to about 6 or 7 percent the hardness and brittleness under shock increases so rapidly that the material is not of any commercial value.

Manganese Steel

In steel containing manganese from 7 percent and up to about 15 percent a curious change of quality takes place; the metal remains very hard but becomes tough upon suitable treatment. This is called manganese steel. Above 16 or 17 percent manganese the metal becomes again brittle and is of no commercial importance. Manganese steel has a high tensile strength and great wearing quality and finds considerable use in light armor plate, burglar proof safes, railroad car wheel tires, frogs and switches and dipper teeth for steam shovels and other heavy steel castings where excessive wearing qualities are needed. A comparatively small proportion of manganese is required each year for manganese steel. Less than 10 percent of the manganese that is used in the steel industry goes into manganese steel. While manganese is important as an alloy in making manganese steel as is chrome in making chrome steel, or nickel in making nickel steel, as tungsten or molybdenum in making steel alloys containing those minerals, yet the really important use of manganese is not in making special steels but in its use in making common steel and it is in this use that there is the greatest tonnage requirement.

OPEN PIT MANGANESE MINING IN ARKANSAS

Spiegeleisen and ferromanganese are crude alloys of manganese and iron, containing some carbon and some silicon. Spiegeleisen includes all iron manganese alloys containing less than 20 percent manganese; ferromanganese contains 20 to 80 or even 90 percent manganese. Commercially iron-manganese alloys containing up to 35 percent manganese are frequently termed spiegeleisen, but texturally they are ferromanganese when they contain more than 20 per cent manganese. The alloys silico spiegel and silico-manganese have similar use to the foregoing alloys but contain from 4 percent to 25 percent silicon.

The alloys silico-manganese and silico-spiegel have up to the present time but limited uses in steel making and will not be further considered in this article. None of these alloys are ever used for mechanical purposes; they are not to be confused with manganese steel. They are kept on hand at the steel making furnaces like medicine at a hospital, to be administered as per directions.

How Manganese is Used in Making Common Steel

Manganese in the form of an alloy, under the common practice, is added to the molten steel at the time of pouring into the mould. About 15 pounds of metallic manganese is required to one long ton of steel. In the open hearth steel practice ferromanganese alloy is generally used, it requires about 18 pounds of ferromanganese to get 15 pounds of metallic manganese. If the steel is being made in a Bessemer converter about 75 pounds of spiegeleisen is used to obtain 15 pounds of metallic manganese.

A practice in steel making possessing very desirable results is obtained by the use of high manganese pig iron instead of using so much manganese in the form of ferromanganese or spiegeleisen. It has been the practice in European steel plants for a number of years. This practice was quite widely followed during the war period in many American steel plants and was considered an improvement in steel making as is evidenced by the statement of the superintencent of one of the large steel plants of America in 1919, which paraphrased is substantially as follows: "The steel industry will be confronted year by year with the ever increasing need of meeting more difficult physical specifications. Can one logically assume that these demands are met by the almost archaic method of hurriedly adding ferromanganese and pouring the steel almost immediately? I am sure the answer is 'No.' The alternative lies in the use of manganiferous iron ores by the blast furnace and the production therefrom of irons carrying high percentage of manganese. There will be found not only material economy in manganese, but a reasonable recovery from the domestic ores and the certainty of a more perfect final product." It is of great importance at the present time on account of the large domestic deposits of manganiferous iron ore that could be utilized for their manganese content.

Both ferromanganese and spiegeleisen are commonly made in a blast furnace of the same type and in practically the same manner in which pig iron is made. The electric furnace has proved satisfactory in the manufacture of manganese alloys but is not generally used.

In the top of a blast furnace a mixture of manganese ore, iron ore, lime stone and coke is charged, the coke is ignited in the bottom of the stack and a blast of air is driven through tuyeres. As the ore is reduced to metal it is drawn off from time to time, run into moulds and when cooled is broken into small chunks to be used as required for its beneficial effects in making common steels or in making manganese steel.

The cost of producing manganese alloys is greater than

MANGANIFEROUS ORE MINING IN MINNESOTA
Operations were carried on upon a substantial scale in this state in 1918

the cost of producing pig iron on account of the higher cost of the manganese ore, the larger amount of coke that is required, larger percentages of losses in the manganese through volatilization and slag, and longer period of time required for smelting.

Other Uses Than in Steel Manufacture

The use of manganese in the arts is of great antiquity, having been known at least as long ago as the time of the ancient Egyptians. It was then used for coloring and decolorizing glass. It was not, however, until the latter part of the eighteenth century when a chemist by the name of Pott discovered that manganese formed a series of salts distinct from those of iron.

While 95 percent of the manganese used goes into the steel industry, it is also an important material in many other trades and professions, viz., as a chemical reagent in the manufacture of other chemicals; in the manufacture of certain dry cell batteries; in calico printing; as a dryer for paints and varnishes; as a coloring for brick, tile and pottery; as a disinfectant and antiseptic and as a constituent of certain proprietary remedies.

Occurrence of Manganese in Nature

Except in meteorites manganese is never found in a free or metallic state, but is always in chemical combination with some other element. It is a constituent of about 112 known and named minerals, most of which are complexly combined with other metals, are but little known, and as a source of supply are of no economic importance.

There are less than ten varieties of manganese ore regarded as a source of that metal for commercial purposes. These are, according to their geo-chemical composition, comprised in three groups, namely, oxides, carbonates and silicates. The most important manganese oxide ores are psilomelane, pyrolusite, manganite, braunite and wad. The first four of these ores vary from hard amorphous or crystalline minerals of greyish, bluish or brown colors, containing up to 69 percent manganese, to wad, an impure mixture of manganese oxide in a soft earthly mineral usually associated with iron ores and which contains from 25 to 40 percent metallic manganese.

Rhodochrosite ore, the only carbonate ore of importance, is a pink rock, quite heavy and contains when pure 47.56 percent manganese. Rhodonite, the only manganese silicate of present economic importance, is a hard pink rock which when pure contains 41.9 percent manganese.

No matter in what part of the world manganese ore is found its geologic occurrence, its physical structure and its chemical contents are matched elsewhere. There is no appreciable difference between the psilomelane in the deposits of Arkansas and the psilomelane from Morro da Mina mine of Brazil, between the pyrolusite ore of Alabama and the pyrolusite ore from Russia. The manganese ores of the southern states are similar in their occurrence and are amenable to the same methods of beneficiation as are the brown iron ores of the southern states.

Sources of Manganese Previous to the War Period

Previous to 1914 the United States was largely dependent upon foreign countries for its manganese. About one-half of its requirements were met by the importation of the alloys of manganese; the balance was manufactured here from ores largely imported from Russia, India and Brazil. Less than 1 percent of the requirements came from domestic ores. America was the only steel producing nation that did not produce most of its own manganese alloys, but like its dye requirements depended upon foreign countries for its supply. Large deposits of iron-and-manganese ores were known to exist in Colorado, New Mexico and on the Cuyuna Range in Minnesota, but these ores did not find a ready market.

Remarkable Change in Source of Manganese Ore.

Through the closing of the Dardanelles in October 1914 the ores from Russia were cut off and due to the activity of the German submarines shipments of ore from India

and Brazil were curtailed. European regulations and the shipping conditions cut off our importation of manganese alloys and America was called upon to supply her own needs. The following table shows the increase of domestic production:

Domestic Production of Maganese-Bearing Ore.

Year	35% manganese ore	10 to 35% ferruginous manganese ore	5 to 10% manganiferous iron ore
1910	2,258	41,260	19,841
1911	2,457	37,584	6,853
1912	1,664	40,863	10,654
1913	4,048	51,512	7,891
1914	2,635	91,666	6,599
1915	9,613	180,953	13,786
1916	31,474	453,853	89,447
1917	129,405	730,759	130,004
1918	305,869	916,163	252,615

The average domestic production of high grade manganese ore from 1910 to 1914, inclusive, had been 2616 tons annually. The production of 1918 is an increase of 11,700 percent over this average.

In 1910 manganese was known to exist in less than a hundred districts in the United States; in 1918 government publications reported it in 427 districts and in 1181 deposits, and many deposits are now known that were not then examined. Manganese is now known to exist in thirty states.

The number of shippers increased from about a dozen in 1910 to 41 in 1915 and to 408 in 1918.

D. F. Hewett, of the Geological Survey, said, "In April, 1917, few, even among the well informed, would have been willing to assume that the successive annual outputs in 1917 and 1918 would each be about three times that of the preceding year."

Still greater production would have followed had the market not been filled from foreign sources by the raising of the war time embargoes for there were about 500 mines either just being opened up or getting fully started. In some districts most of the activity was devoted to development, the sinking of shafts, stripping deposits with steam shovel, or the erection of washing plants. By another year the production would likely have been trebled again, and through the application of more approved mining methods and the beneficiation of ores the grades would have been highly desirable.

Domestic and Foreign Manganese Reserves

Russia, India and Brazil contain large reserves of manganese ores. Since the war period 80 to 90 percent of the foreign manganese ore has come from Brazil; 80 percent of the Brazilian exports to the United States are from the Morro da Mina mine, now owned by the U. S. Steel Corporation. Due to intensive mining, government reports tell us, the grade of ore from this mine has fallen down from its former averages of 48 to 50 percent until now anything over 40 percent is acceptable. There is, however, no question but that foreign ores of suitable grade can be obtained to meet America's requirements for many years if America again permits herself to become dependent on foreign countries for manganese as it was before the war.

No one is sufficiently informed as to our domestic reserves to place limitations upon them. The reports of the U. S. Geological Survey estimate that the domestic manganese ore reserves would last the country but two or three years under normal consumption. The only ore taken into account as a basis of this estimate is ore containing 35 percent or more manganese of which there is in existence, according to these reports, only 699,750 tons proved and additional ore in prospect 1,130,000 tons.

The estimates on reserve tonnages in the government reports have not been revised since 1918. The investigation on which those reports were based was made in 1917 and 1918 but did not take cognizance of the tremendous development that had taken place by the latter part of 1918, and the reports that are published this year do not take cognizance of the recent development in manganese mining. For instance, one district in which the government reports throughout these years estimated only 2800 tons of high grade ore, has shipped 166,650 tons, and the owners claim there are millions of tons still left in the ground. Other districts have produced more ore than was credited in government estimates and it is now felt by many who are familiar with the manganese ore situation that government estimates seriously belittle domestic manganese reserves. Much data have been collected within the last few months from various authentic sources as to domestic reserves and grades with the result that greatly increased tonnages and grades are disclosed.

Cumulative data indicate greater reserves than the old reports give credit, and adaptation of improved metallurgical practice increases the period of time our domestic manganese reserves will sustain the steel industry, as is shown by the following:

(1). That there is now a much larger tonnage of high grade manganese oxide ores known.

(2). That there is now a much larger tonnage of high grade manganese carbonate ores known.

(3). That there are greater tonnages of ferruginous manganese ores now known and that these ores are suitable for steel making and should be taken into account in estimates of reserves.

(4). That there are greater tonnages of manganiferous iron ores now known and that these ores are suitable for steel making and should be taken into account in estimates of reserves.

(5). That there are large quantities of manganese ores of good quality that are capable of beneficiation by washing processes similar to the method of preparing the brown iron ores, and that these ores constitute reserves of manganese that should be taken into account.

(6). That many of the ferruginous manganese ores and the manganiferous iron ores which have a combined metallic content less than generally accepted from smelting are capable of beneficiation and should be considered a part of the domestic manganese reserves.

Assuming that the estimates of the high grade reserves by the Geological Survey have been uniform, and assuming that the disparity in these estimates with the tonnages that have subsequently been proved to exist, are indices of the general disparity between the estimated and actual tonnages throughout the country, and taking into account the vast tonnages of metallic manganese available in lower grade ores and in ores that are mixed with iron, it is safe to assume that the manganese ore reserves of the United States will last the steel industry as long as the present known high grade deposits of domestic iron ore will last the steel industry. Ninety-five percent of the manganese consumed is used in the steel industry. An amount equal to about 2 percent of the annual steel production is a fairly close estimate of the manganese required in any year.

Manganese and the Tariff and Military Emergency

The Fordney Tariff Bill includes a schedule for the protection of the manganese industry in which a duty of one cent per pound on the metallic content of ore, and 2 1/5 cents per pound on the metallic content of ferromanganese, is provided.

There are two classes of people primarily interested in this schedule, (1). The producers of ore and the operators of merchant blast furnaces making alloys, who desire the tariff; (2) The steel manufacturers, the owners of foreign

mines and the brokers of foreign ores and alloys, who are against it. The opponents of the schedule, relying upon the obsolete data regarding domestic manganese reserves, claim that those reserves should be retained for use in case of military emergency. The proponents of the manganese tariff schedule claim that this policy is fundamentally unsound and that it is based upon a false premise; that there are large reserves of manganese bearing material in the country, and that these should be developed to insure our commercial independence and protect our country in case of military emergency.

In case the United States should be so unfortunate that it would again be involved in war and an enemy nation should make a sudden attack by sea and should succeed in cutting off supplies of foreign manganese ore, our steel industry might be in a more serious plight than existed in 1918, for the condition that existed in that year had developed slowly.

Of what value would our vast resources be if locked in the inaccessible recesses of the earth? The manganese mines could not be quickly reopened and put on a producing bases. It takes time to develop mines.

Not only should a nation have for its protection armies and navies but those industries required to sustain them and sustain the existence of that nation in case it should be cut off from outside supplies. The manganese industry is one of those essential industries that should receive protection until it has reached a stage where it could be self-sustaining.

"An entirely undeveloped natural resource in the time of a national emergency is as useless to a nation as an entirely depleted one."

THE TUNGSTEN INDUSTRY

By Nelson Franklin

LITTLE is known generally of the element tungsten, as its use was limited until the war period, when it became general in speeding up the war program.

The principal use for tungsten is in an alloy of tungsten and steel in the manufacture of "high speed steel," which in the standard grade carries 18 percent tungsten. About 95 percent of the world's production of tungsten goes into high speed steel. A small percentage, probably not over one percent of the world's output goes into the manufacture of tungsten electric lamp filaments. Tungsten steel is also employed to some extent in valves for internal-combustion engines, it being harder than other kinds of steel and better able to withstand the heat from exhaust gasses.

Importance of the Industry

Machine cutting tools made of tungsten "high speed steel" have the property of maintaining their temper and cutting edges when traveling at a high rate of speed and under a red heat, when ordinary carbon steel tools would be rendered useless. Machine cutting tools made of tungsten "high speed steel" permit five times the output of work per man and machine possible with the old style carbon steel tools, hence the almost universal use of tungsten steel tools during the war period when labor was high and also the greatest possible speed was necessary in carrying on the war armaments and munitions program.

Tungsten Mining History

Tungsten was first discovered in the U. S. in 1900 in Boulder County, Colorado. There was a considerable quantity of float ore scattered over the surface of the ground, caused by the erosion through centuries of the outcrop of the various veins. This float material was in the form of nuggets, being high grade, having been freed of much waste material by the elements and required very little hand sorting or cobbing to make a shipping product of 60 percent tungstic trioxide which is the standard grade. Tungsten at that time was in little demand with the consequent very low price of from $2 to $6 per unit, a unit being 20 pounds of tungstic trioxide or one percent of a ton, which is the commercial basis on which tungsten is marketed.

The float ore however could be profitably gathered during the few years following and when the demand increased and with it an increase in price, the float soon became exhausted and mining was resorted to at shallow depths.

Mined tungsten ore which has not been exposed to the elements and as it comes from below the surface, is of low grade, carrying as low as one half of one percent to higher percentages in rich kidneys in the veins and requires concentration before it is of value commercially. Small makeshift plants of jigs and tables were at first employed and later as the demand increased and the price warranted it, large and expensive concentrating mills were erected and at the conclusion of the war there were over 25 large finely equipped tungsten concentrating mills in Colorado, Nevada, California and Arizona. Tungsten mining started in California in 1908 in the Atolia mine at Atolia, which property later became famous as a high grade mine of large resources.

Up to this period all the U. S. production of tungsten had come from Colorado. Later, and during the war period when prices for tungsten warranted investments, deep mining was started in Colorado, many new discoveries were made, large concentrating mills were erected and during 1915, 1916, 1917 and 1918 Colorado companies, notably the Tungsten Products Co., the Wolf-Tongue Co., the Primose Co., the Vasco Co., the Boulder Tungsten Production Co., the Rare Metals Ore Co., and the Mojave Boulder Tungsten Co., from their properties produced and furnished a large proportion of the tungsten consumed in this country for war purposes.

In 1916 there were discovered several very large low grade contact metamorphic deposits at Bishop, California, notably the Tungsten Mines, the Standard Mine, the Round Valley Mine, and the Pine Creek Mine. These properties were in time extensively developed and equiped with large concentrating mills and furnished a large amount of tungsten for war purposes during 1917 and 1918.

Late in 1917 several large contact metamorphic deposits of low grade ore were discovered in Nevada, notably the Pacific Tungsten Mine, and the Nevada Humboldt Mine, both of which have extensive development, are equipped with large plants of mining machinery and large concentrating mills but were only ready for production at the time of the signing of the armistice in 1918.

The accompanying table gives a complete history of the tungsten industry up to date, showing U. S. production, world production, U. S. imports, U. S. exports, U. S. low price and U. S. high price, from 1900 to 1920.

A study of the table will show that during the war period the world supply at one time did not equal the demand, consequently prices soared, which stimulated research resulting in the discoveries mentioned previously and the investment of vast sums of money in the tungsten mining industry. To economically handle the low grade ores it requires large plants of machinery and concentrating devices, as frequently it requires 200 tons of mined ore to produce one ton of concentrate carrying 60 percent tungstic trioxide, which is the standard commercial product.

Up to within a few months of the close of the war, our imports came principally from South America and very little came from China, but during 1918 the Chinese discovered a new field, vast in extent, covering several hundred miles in length and 2 to 8 miles in width, over which was scattered over the surface large quantities of float ore of high tungstic trioxide content, and which with very little hand sorting could be made ready for shipment. China promptly commenced to export to this country large quantities of this ore, produced at an abnormally low cost, and a large proportion of the imports showing in the table arrived after the armistice and a large quantity is still on hand in warehouses at seaboard owing to lack of demand, consequently the price has receded to the low figure of $3 per unit, which is below the production cost in China, plus the low transportation charges to the U. S.

NELSON FRANKLIN

Present Condition of U. S. Tungsten Industry In All Its Branches

Mining—It is conceded that the demand for tungsten ore at present is subnormal, as the alloy steel industry is in the same deplorable condition as the common steel industry with the demand at a very low ebb

The normal requirement has been variously est mated at between 5,000 and 7,500 tons of 60 percent tungstic trioxide concentrate. The demand at present is very small owing to the condition of the refining industry in the making of ferro tungsten and tungsten powder, which is later explained. The mining of tungsten in the U. S. entirely suspended at end of 1918 and not a pound of ore has since been produced.

Refining—The refiners of tungsten ore into ferro tungsten and tungsten powder, although they can purchase Chinese ore at as low a cost as can the English manufacturers, are unable to compete, and of those products at present consumed in this country, it is all imported from England at a price much below the cost of production in the U. S.

Over 35 large plants for the manufacture of these products were established at the beginning and during the war period and they are now all shut down.

Tungsten Steel Making—The many large crucible and electric furnace plants in the U. S., many of which were erected for the manufacture of "high speed steel" are entirely shut down on the making of that product, as they cannot compete with the British under present conditions, although being able to purchase ferro tungsten and tungsten powder imported from England at very low prices.

Legislation

Since the armistice, legislation has been asked of Congress for protection to this important industry, which cannot exist in any of its branches without it. The Timberlake Bill known as H. R. 4437 passed the House in August, 1919, was reported favorably with amendment to the Senate in March, 1920, but failed of consideration by the Senate. The present Fordney Tariff Bill, H. R. 7456, provides a duty on ore sufficient to permit the production of a limited amount of ore in this country, but the duty is not sufficient to allow the maximum production or sufficient to supply a normal demand, neither will it encourage the equipment of large known ore deposits of low grade ore.

Under adequate protection, the accumulated imported stocks in this country would gradually become absorbed and mining, refining and tungsten steel making would again be resumed and this country would be industrially independent for its supply of this very essential key mineral in which, owing to the exigency of war, there were invested in mining, refining and steel making, many millions of dollars, which can be employed, and would give employment to thousands of American workmen in the mines, refineries and steel plants.

Conclusion

Prior to the war our tungsten ore was shipped to Germany, was refined there and shipped back to us. The control of Germany on the refined product has now passed to England and along with it the British now absolutely control the markets of the world on the ultimate product "high speed steel."

It is to be hoped that Congress will allow the tungsten industry to continue in this country by protecting it to the extent of a duty on ore sufficient to equalize the cost of production between this country and China and a duty on all the finished products of tungsten sufficient to equalize the cost between this country and England.

TABLE SHOWING HISTORY OF TUNGSTEN PRODUCTION

YEAR	World Production Short tons of 2000 lbs.	U. S. Production Short tons of 2000 lbs.	U. S. Imports Short tons of 2000 lbs.	U. S. Exports Ferro Tungsten Equivalent to Short tons of 2000 lbs. Ore	U. S. Low Price Per Unit	U. S. High Price Per Unit	REMARKS
1900 to 1903		Discovery Period Production Small.			2.00	6.00	1900—First discovery of Tungsten in the U. S. in Boulder County, Colorado.
1904		500			6.00	7.00	
1905		750			5.00	6.00	High Speed Steel first manufactured in U. S.
1906	4,400	1,000			5.00	9.00	
1907	6,250	1,750			6.00	11.00	Price rose to $11.00 supply increased, price dropped to $6.00.
1908	4,250	700			5.00	8.00	Decrease in price, production dropped. Tungsten mining started in California.
1909	5,500	1,500			6.00	7.00	
1910	7,570	1,821			5.00	7.50	
1911	7,517	1,139			6.00	7.50	
1912	9,654	1,330	1,500		5.00	8.00	Marked increase in manufacture of High Speed Steel.
1913	8,476	1,500	2,100		6.00	8.00	Decrease in price and tonnage at end of year.
1914	7,879	990	800		5.00	9.00	U. S. decrease in tonnage caused by exhaustion of rich surface ores and low prices.
Prior to 1915 the price was maintained in close limits by the discovery of new foreign fields the moment price increased led to stimulation.							
1915	12,328	2,332	1,800		5.00	60.00	Stimulus of high prices at end of year caused activity and increased tonnage.
1916	25,670	5,900	4,000	600	18.00	92.50	The high price prevailed at beginning of year and a large number of new properties were exploited giving increased tonnage.
1917	27,060	6,144	5,000	2,500	17.00	25.00	Many new discoveries were made under the stimulus of these prices and output increased.
1918	36,500	5,029	11,600	1,250	12.00	28.00	The large contact metamorphic deposits of Nevada were ready to produce when they closed down owing to fall in prices.
1919	22,600	330	10,635	42	6.00	10.25	Mining entirely suspended in U. S. except to complete unfilled contracts to extent of 330 tons.
1920	Figures not complete. Estimated at 10,000.	None	4,320	None	3.50	6.00	No refining of Tungsten in U. S. The imports of 4320 tons were partly ore and partly ferro Tungsten and Tungsten Powder, equivalent to short tons of 2000 lbs. ore.

EFFICIENT OIL DRILLING MADE TOPIC OF TREATISE

THE BUREAU OF MINES has issued a report on the relation of oil drilling campaigns to income from oil property. It points out that in periods of low prices for oil, such as exist at the present, the margin of profit is at the best very small, and the correct determination of the drilling campaign may be the deciding factor between incurring financial loss or gain during the depressed period. The report covers matters relating to the general policy of the operator and the loss of recovery of oil from delay in drilling, including data showing effect of time of drilling on ultimate recovery. It discusses methods of determination of drilling campaigns and analyzes data obtained in investigations made in the Buena Vista Hills area, Kern County, California, and the Tract in Caddo field, Ferry Lake District, La.

The report enters into a detailed discussion of determination of proper spacing in order that the operator may produce and market all available oil at the earliest possible time, thus insuring the early return of expended capital for the re-investment. Tables are produced to show the difference in ultimate production per acre, in several pools, due to variation in spacing of wells, observations for which were made in various fields in Oklahoma, Pennsylvania and California. The conclusion is reached that the determination of the proper ultimate spacing for a large tract need not be undertaken until after the protecting offset line wells have been drilled, and for tracts where wells have been drilled, according to a scattered program until after the completion of isolated or scattered wells.

THE ZINC ROOFING SITUATION

By Edgar Z. Wallower

DURING RECENT YEARS when production and consumption of zinc have maintained a lively gait, the subject of wider uses of zinc did not arouse much organized enthusiasm among those most vitally interested.

Under present conditions when the rate of consumption is less than half of the 1920 average and still less than the actual production by at least 28,000 tons a year, the mine operator and smelter hold quiet communion of thought and speculate on how and when all this zinc is to be used. The announcement of some new process or industrial application that would forthwith consume a large tonnage of zinc would certainly bring prolonged applause from both.

As an industry we are fairly acquainted with the use of zinc in galvanized materials of all kinds and especially for building purposes. We are also quite sure that when Mr. Farmer gets busy in his long delayed program of fixing up the barn and the tractor shed, and repairing the galvanized barbed wire fencing, which is now falling to pieces through the ravages of rust, there will be a lively demand for zinc covered products, from the steel mills. But Mr. Farmer is not quite ready for this program, for he still has some notes to pay at the bank. Furthermore, he is still a little sore about the galvanized sheets he bought in 1913 and 1914, which have long since begun to peel and rust.

The zinc coated wire which he carefully put up before the boys went off to war is no longer zinc coated, and he wants to know what he is getting the next time he buys.

I talked with one of them at the county fair this year and asked him why he didn't put sheet zinc or at least galvanized siding or roofing on his barn instead of prepared roofing. He said he had inquired about the cost of sheet zinc but it was a little too expensive for him at this time. As for the galvanized material, he said, "If you fellows in the zinc industry are so sure about your zinc coated materials, why don't you establish standard specifications for galvanizing and advertise them all over Main Street? Then I will know as much about what I am going to get as when I buy a well known model of rough riding car. As it is now, I can only take the salesman's word that it was single dipped or double dipped and that doesn't mean much to me." There is something in what he says.

The galvanizers have been good friends and almost the largest customers of the zinc industry. And it is with only the friendliest feeling that we urge them to brand their goods, advertise the firm back of their brand, and adopt a standard set of specifications for galvanizing sheets and pipe and wire. It is the old story of putting the quality stamp and the backing of the firm on every piece of goods so that the customer may know what to expect, and whom to blame in case of trouble.

With the opening out of the Oklahoma-Kansas-Missouri field in the Joplin district, undoubtedly the richest zinc field in the United States and probably the most productive in the world, the capacity of our zinc mines expanded far beyond the bounds of demand of the galvanizers and brass makers combined. The result has been that the economic law in curbing production has brought zinc ore and metal prices to exceptionally low levels, and the natural result should be the opening up of new uses of metal made possible by lower prices.

We have been told many times by the manufacturers, of the multifarious uses of sheet zinc—the shoe lace tips, the pencil ferrules, wash boards and the much vaunted corset eyelet (which we must take on faith). They are all excellent applications, but they do not involve a great tonnage. In the Joplin district nowadays the producer sells in units of hundreds of tons of concentrates while formerly the large unit was a car load. Production from this district with zinc concentrates at $20.00 a ton is larger than the average output of the Missouri sheet zinc mines with prices ranging from $40.00 to $60.00 a ton.

EDGAR Z. WALLOWER,
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It is therefore logical to assume that if prices are to return to the former levels some new outlet for the metal must be found to absorb the resulting production. A movement in this direction has been gathering headway for nearly two years, which has great import for the future of the zinc people. The movement of which I speak, the real "white hope" of the zinc industry, is the practical application of sheet zinc for roofing purposes. In a way there is nothing new or startling about the use of zinc for roofing. It was rolled into sheets as early as 1807 and we have record of zinc roofs in Belgium in 1811, many of the roofs installed from 1820 to 1850 being still in service. Its permanence being capable of absolute proof, why is it that there are no more zinc roofs in the United States? Someone has certainly been asleep.

Realizing that the fortunes of the mine operator and the smelter were closely interlinked, the American Zinc Institute was organized several years ago, with the firm determination to use their combined energies for the betterment of the industry and the wider use of the metal.

A peculiar feature of the zinc industry from its early beginnings in this country has been the fact that the miners as a class have been independent of the smelters, with the result that instead of close co-operation for their mutual good there has nearly always been an economic warfare. The first thing the Zinc Institute had to do was to bring the opposing elements together on a basis of personal acquaintanceship and mutual confidence. This was necessary, on the face of it, before any co-operative work could be undertaken, and by earnest efforts on both sides was accomplished. Next they set about to make a scientific study of zinc roofing, sent an expert to Europe to secure the methods and applications in successful practical use over there, and made arrangements with one of the most prominent firms of architects in this country to have

these methods applied to American practice. The Institute has prepared work sheets showing the application of zinc for practically all roofing purposes, in a manner that can be easily understood and applied by an ordinary sheet metal contractor.

This has been followed by the announcement of the manufacture of sheet zinc shingles by several zinc rolling mills and some small concerns devoted exclusively to this product. They have already made fair progress, the industry as a whole beginning to show its faith by using zinc shingles for roofing and at least setting an example.

For some reason the zinc roof about 40 years ago received a decisive set back, possibly as some suggest due to the fact that its everlasting qualities would give hope of few return jobs to the sheet metal worker. That can hardly be credited, as the metal crafts have used copper for cornice and roofing work without prejudice as to its indestructibility and in spite of its higher cost. The true reason probably is that the metal was used in the beginning for roofing purposes without full knowledge of all of its properties, on the general assumption that it could be treated in the same manner as copper or tin plate.

The fact that it could not be bent and worked as freely as copper led to the assumption that it could not be safely bent or worked at all. That may have been true some years ago, but I have bent sheet zinc of roofing gauge five or six times without sign of cracking, which would indicate that this argument hardly applies at the present time. The problem of expansion allowances was a serious one and the oversight of this factor caused leakages which were damaging to the use of zinc. Expansion of the metal requires very skilful attention, especially in a batten type of zinc roof. I was shown a roof of this type on a bank building not long ago. It was laid under the supervision of the manufacturer of the sheet zinc used and is as permanent as the foundations themselves.

Another difficulty was that rapid corrosion took place when zinc roofs were fitted with copper flashings and down spouts, electrolysis causing the rapid breakdown of the zinc. This matter was little understood and caused zinc to be generally condemned for roofing purposes.

It is hard to understand why the tin roof with its regular coat of red paint every few years gained any headway, but there was no generally acceptable substitute at the time it became established. Except for repainting it needed little repair and was thoroughly leak-proof.

The materials which came into general use up to the time of the war, briefly summed up as to their deficiencies were the following:—tin roofs, with high maintenance costs; slate roofs with high cost of installation, heavy weight and leakage due to easy fractures; wooden shingles subject to rapid deterioration and great fire hazard; tile roofs, high first cost, and excessive weight; prepared paper roofings, relatively short life.

Of recent years the asbestos shingle, the paper asphalt compound shingle, and especially during the war, the prepared paper roofing applied under standard specfications and careful inspection, received a tremendous impetus. The zinc industry was busy supplying war demands at prices that made zinc roofing well nigh impossible, and in the meantime the new winners of the field with great foresight were spending part of their profits in educational propaganda, preparing a stout defense against future competitive attacks.

The zinc industry now enters this field so strongly outnumbered by the forces of trade custom, prejudice and organized selling and distributing agencies of other roofing materials that it seems a very weak David in a veritable field of Goliaths. Further the industry itself is admittedly ill organized, due to the large number of small independent producers and the lack of team work among the larger ones. But the odds against success in this field are not as one sided as one might at first suppose. This David has just begun to fight.

It is common knowledge that the need for dwelling houses of all kinds will cause a wide spread building campaign just as soon as labor and building materials become adjusted, or to speak plainly, can be bought at lower and more stable prices. It is undoubtedly with the thorough understanding of this situation that the various manufacturers of prepared roofing materials have been conducting vigorous publicity campaigns for their products. As a matter of fact much more building of this type of construction has been going on during the year 1921 than generally appreciated.

The following figures of building construction in the United States are very significant:—

Valuation of Buildings Started
(Bahsons)

	June, 1920	June, 1921
Residential Buildings	$ 44,339,400	$ 75,174,800
Total All Construction	$260,833,600	$227,710,900
	January 1 to July 1, 1920	**January 1 to July 1, 1921**
Residential Buildings	$ 348,580,000	$ 360,828,000
Total All Construction	$1,742,585,305	$1,066,256,100

Detailed analysis of the above summaries indicates that while business and industrial building construction is at a low ebb, there is a substantial gain in dwelling house building. In fact, relatively greater than the figures indicate, as prices are lower this year than last. There will be a strong demand for roofing material of one kind or another, and the decision as to which type will prevail will rest finally with the building contractor and the architect, especially the latter. Unless the prospective owner of a dwelling has some definitely preconceived ideas on the subject, he will defer to the opinion of the architect. The architect as a rule is a conservative person, not desiring to take any chances, and it is at this point that the convincing argument must finally be made.

The zinc industry as a whole should look this problem squarely in the face, and find out if possible why zinc for roofing has been so slow a development and what can be done to stimulate it.

In the first place the zinc shingle, with due allowance for its indefinite life, cannot now compete on a price basis with the ordinary asbestos or prepared paper shingle. When the builder gets as far along as the roof, and finds as is invariably the case, that costs are exceeding estimates he feels he cannot afford $20.00 a square for zinc shingle when he can secure a fire proof shingle at half the cost and probably good for 10 or 15 years.

The industry is in great need of a process for the manufacture of a sheet zinc shingle directly from Prime Western slab zinc. A brief outline of the present process is an explanation in itself of why the sheet zinc shingle is so expensive. In the case of one manufacturer, the raw product or zinc concentrate is purchased in the Joplin district, and shipped to a smelter nearly 200 miles south of the mines, where cheap gas for smelting is obtainable. The metal is then shipped to a point in Indiana where it is remelted and re-cast, after which it is held in a soaking pit for a period of time in order to establish uniform temperatures, after which it is run through a roughing mill and later rolled in bundles through a finishing mill. The large sheets are later cut up into small pieces and then stamped into the sheet zinc shingle. This schedule of production is not stated as a reflection upon the manufacturer, but as one reason why the costs are so high. It is not peculiar to his own case, but applies with more or

less accuracy to all manufacturers of sheet zinc shingles. The reason of course is that the field has not yet broadened out to a point where there is a sufficient demand to warrant the production of zinc shingles in one continuous heat from the raw to the finished products. Henry Ford has begun to make this economy in the castings for his motors, only after many years of manufacturing during which other economies were made first.

The sheet zinc shingle must come within at least 50 percent of the cost of the prepared roofing materials in order to carry the day, and this can be accomplished in only two ways, one of which is to wait until the unstimulated demands will warrant a large and economical production, the other method being to take a speculative chance, build a plant where these economies can be made by processes which involve the least possible losses in fuel and skilled labor, and force production by the expenditure of an adequate appropriation for advertising and sales promotion. In this case such an appropriation would be just as much of a capital investment as the cost of the machinery. There is so much money apparently ready at all times for mining ventures of a highly speculative nature, that it seems unfortunate that no one is quite ready to step out into this field which when entered in the proper manner should yield such bright returns.

Secondly the manufacturers have been inclined, on account of their previous trade connections with sheet metal contractors, to place the zinc shingles through them exclusively. If the future of the sheet zinc shingle must depend upon its acceptance by the sheet metal contractor, who is forced to install it without violating any of the many and complicated rulings of the building trade unions, we are bound to admit that the proposition is crippled at the outset. The zinc shingle is so simple to lay, that a carpenter's helper or an ordinary laborer, trained to do this particular thing can place it neatly and without any difficulty. The lumber dealer sells roofings of all kinds, and has no antipathy to the sale of a zinc shingle if there is a fair profit in it for him.

Thirdly, the zinc roof has difficulty in meeting the competition of the brightly colored red or green prepared shingle, so much desired for decorative effects. This factor in a way eliminates it from the field of high priced residences where the cost is not so great a factor, and pushes it back to the lower priced house where every dollar in first cost is made to count. One manufacturer however, is oxidizing his shingle before shipment, removing that "tinny" appearance and giving the shingle its permanent cast, which is very pleasing in appearance.

These three obstacles, first cost, poor distribution and color, I believe, are at the bottom of the trouble. But they are not impossible of correction. Gradually processes will be developed that will cut the corners of costs and as volume of the output increases the zinc shingle can be placed on more nearly a competitively even price basis and its durability will act as its sales agent. In other words if we can come close to the other fellow's price the zinc shingle will practically sell itself.

Once it is demonstrated that they are salable, they should be put into the hands of every hardware merchant, lumber dealer, country cross roads general store and every roofing contractor. The high priced colored shingle may have its own field for a time if the zinc shingle can be sold over the counter anywhere the builder of an ordinary house turns to buy. It may involve placing the goods on consignment, but if it can be proven that the builder can buy and with ordinary carpenter labor place a zinc roof at near the cost of a prepared roof covering, the industry is strong enough to finance such a consignment plan, no matter how extensive. The value of 75,000 tons of zinc concentrates in the bins of the operators in the Joplin district, combined with the stocks of nearly 100,000 tons of metal in the hands of the smelters, would if properly combined in an aggressive co-operative plan form the basis for all the financing necessary.

In conclusion, the use of sheet zinc for roofing, like Banquo's ghost, will not down. In spite of handicaps and difficulties on all sides, the zinc industry as a whole is firmly confident that in the future, one of the chief outlets of productive capacity of zinc in this country will be in the various types of sheet zinc roofings.

HEAVY LEAD DEMAND DURING NEXT DECADE FORESEEN

By S. M. Evans
President, Eagle-Picher Lead Company

THE FUTURE GROWTH of the lead business is a most gratifying study. The demand for this metal is certain to be very much larger in the next decade than ever before, due in part to a continued acceleration of the requirements of the white lead industry and in part to the developments of that great industry which is responsible for the tremendous expansion in the copper business during the last twenty years, namely the electrical industry.

The evident disposition of Congress in relation to our chemical industries, in effect insuring their permanence and growth, will create large new demands for lead of a regular and permanent character. The constant expansion of the telephone business in the United States, the enormous building requirements of the country which must be taken care of during the next five years will further augment the demand for this metal. Indeed, the record of consumption of all these industries for the past five years projected into the future for five years indicates a requirement of metallic lead so large that it is a question among those interested in the lead business just where the supplies are going to come from. With the exception of the lead which occurs as an incidental to the great discoveries of zinc in the Oklahoma-Kansas field, no major deposits have been found in the United States in the last twenty-five years, while several large properties have been bottomed.

The relationship, therefore, of supply and demand will undoubtedly result in a strong stimulation in the way of high prices, the result of which no doubt will be the discovery and exploitation of new fields. As the United States doubled its zinc output in three years by reason of war necessity, it may easily be that we shall witness similar developments in the lead industry within the next decade.

COPPER EXPORT ASSOCIATION

By F. H. Brownell

THE Copper Export Association has been, and should be, of the greatest service to all miners of copper in the United States. It is not, in any sense, a money making concern, but is an association organized under the Webb Act for the purpose of enabling American producers of copper to unite in handling their foreign sales. It is highly desirable that every producer of copper should really understand this fact and should co-operate to the fullest with the Association in achieving its desired end.

Prior to the World War, nearly sixty percent of the copper produced in the United States was sold in Europe. Of this amount, Germany took a large proportion. The German buyers were permitted, and even encouraged, by their government to unite for purposes of buying and of dealing with foreign countries. As, at that time, under the Sherman Act, the American producers were not permitted to combine, either for domestic sales or for foreign sales, it is obvious that the foreign buyer had the American producer at a great disadvantage and everyone acquainted with the negotiations of that day knows that the American producer realized less for his copper sold abroad, and especially in Germany, than he would have been able to realize had an association like the Copper Export Assocaition been permissible.

In the early stages of the war, before the United States became involved, there soon developed a tendency on the part of the Allies to pool their buying, and this attitude again placed the producers of copper in the United States at a considerable disadvantage. The allies, acting as a unit, were able to make good bargains among the disorganized producers of the United States.

The situation in copper was not unlike the situation in many other lines of production. More and more, the business men of the United States began to realize that, in order to compete with the united action of European powers, it would be necessary for the American producers to be permitted likewise to unite. But any form of combination had long been forbidden by Congress. The enforcement of the Sherman law, with its prohibition of combinations, had been carried to extreme length, and further than was perhaps really intended by the framers of that act, and it was evident that some modification was necessary or the foreign trade of the United States would suffer seriously.

Accordingly, there was brought before Congress the so-called "Webb Act," which specifically permitted producers of a similar character in the United States to combine, so far as their foreign activities were concerned, provided that thereby prices were not enhanced or depressed or competition lessened in the United States itself.

Mr. John D. Ryan, then president and now chairman of the board of the Anaconda Copper Company, realized the importance of this act to the copper industry, and it was largely due to his able presentation of the facts to the committees of the House and of the Senate that the Webb Act was finally passed.

After the termination of the war, most of the main copper producers of the United States decided to organize an Association under this act, for handling sales of American copper in foreign countries.

F. H. BROWNELL
Chairman of the Board of Directors, Copper Export Association

Every producer of copper in the United States was, and is, not only invited, but earnestly requested, to join the Association.

The contract obligates the joining members to sell no copper for foreign use, directly or indirectly, except through the Association. For its services, the Association charges only actual costs to it.

The copper sold by the Association is divided among its members each month in the same proportion as the amount which each member has available for sale abroad, compared to the total so available. There is thus an exactly equitable and proportionate division of all foreign sales made among the members of the Export Association and all receive the average price for each month. No one member is permitted in any way to gain an advantage at the expense or detriment of any other member.

The intent is to give to the members of the Association every advantage realized, dividing the sales in exact, equal justice among them, both as to quantity and as to price.

Each member of the Association is entitled to a vote, based upon the tonnage of copper that he has contributed during a given period preceding the stockholders' meeting.

No dividends are declared upon the stock of the company, excepting seven percent upon $20,000 worth of preferred stock, which was issued and taken at par, in order to equip the offices of the company and to pay the expenses incident upon organization and establishment of agencies in foreign countries.

The Copper Export Association was organized in 1919. The following copper companies (enumerated in alphabetical order) now constitute its membership: American Smelting and Refining Company; Anaconda Copper Mining Company; Arizona Copper Company; Calumet & Arizona Mining Company; Calumet & Hecla Mining Company; Chino Copper Company; Consolidated Coppermines Company; Greene Cananea Copper Company; Inspiration Consolidated Copper Company; International Smelting Company; Kennecott Copper Corporation; Nevada Consolidated Copper Company; New Cornelia Copper Company; Nichols Copper Company; North Butte Mining Company; Phelps-Dodge Cor-

poration; Ray Consolidated Copper Company; United Metals Selling Company; United Verde Copper Company; U. S. Smelting, Refining & Mining Company; Utah Consolidated Mining Company; Utah Copper Company.

Mr. John D. Ryan acted as president of the company for the first two years of its organization, devoting a large part of his valuable time to the service of the company without salary or other compensation. In fact, no officers of the Association receive any salary, excepting only the secretary and those engaged exclusively in handling the operating and clerical work of the company. Neither the president, vice-president, nor any director receives any compensation whatsoever. Their services are given gratis for the welfare of the copper industry as a whole.

After two years of devoted service, Mr. Ryan felt that the burden of the presidency should be passed to other hands and was succeeded by Mr. R. L. Agassiz, president of the Calumet & Hecla Mining Company, the present able and enthusiastic director of the Association's activities.

While the Association has existed only through the period of the most demoralized foreign trade the United States has ever known, it has demonstrated its value to the copper trade of the country and the wisdom of Congress in passing the Webb Act, which permits an association of this nature and kind to further the foreign trade of the United States. The price received by the Association in its foreign sales has been higher than has been realized during the same time from sales of copper made in the United States. (The Association itself, of course, does not sell any copper whatever, directly or indirectly, within the borders of the United States. Its activities are limited by law solely to the foreign trade.)

Prior to the organization of the Association, the reverse was generally true and buyers of copper in the United States usually paid more for their copper than the foreign buyers of copper. This placed United States manufacturers at a disadvantage. It was, however, the inevitable result of the old system, under which a united foreign buying could take advantage of a divided United States production.

The Copper Export Association has been of great value to the trade, in affording a convenient organization for the extension of credits to European customers, particularly in France, enabling these customers thus to manufacture and re-sell the copper before having to pay in full for the raw product. Continued credits extended over a long period of time will also give to the foreign buyer an opportunity to take advantage at a later date of a more favorable rate of exchange.

The Association has realized that it is necessary to extend every reasonable aid in the shape of a proper credit in order to enable European customers the more quickly to resume their normal activities and their consumption of our copper.

At the present time, the European consumption of copper is far below what it was prior to the war. This is due to the lack of money with which to pay for copper, rather than to a lack of demand. With the reconstruction of Europe, a tremendous need of copper is inevitable. The rehabilitation of telegraph and telephone lines, of street railways, of hydro-electric power lines and especially the construction of new hydro-electric power lines, made inevitable because of difficulties with coal experienced through the last few years, all point to a great demand for copper in the future, as soon as Europe has recovered somewhat from the first disastrous effects of the war and is again in a position to take up the activities of a period of peace.

More and more as the business condition of the world becomes normal will the Copper Export Association be found to be of advantage to the American copper producer.

In its limited field, it is comparable with the American Mining Congress itself, in that it is an institution organized and conducted to further and aid the business of selling copper abroad, just as the American Mining Congress is organized on a greater scale to further and aid the entire mining industry of the United States in all its branches.

The Copper Export Association realizes and deeply appreciates the benefits to the mining industry obtaining from the American Mining Congress, and hopes for its support and encouragement in meeting the difficulties of increasing and improving the sale of surplus American copper abroad.

FOREIGN AND DOMESTIC COMMERCE BUREAU TAKING SHAPE

HENRY C. MORRIS, of Washington, D. C., has been appointed head of the new Fuel Division of the Bureau of Foreign and Domestic Commerce. The selection was announced by Secretary Hoover early in September and Mr. Morris assumed office at once.

Mr. Morris is a graduate of the Massachusetts Institute of Technology and has had experience as a mining engineer in Colorado, Nevada and California and examining work in Mexico, Canada and Missouri. He entered the service of the Fuel Administration as a mining engineer in 1917 and in May of 1918 was transferred to the Bureau of Mines. His work there included membership on the Capital Issues Advisory Committee and related applications thereafter on the War Minerals investigation. He was nominated by Secretary Lane as a representative of the Bureau of Mines on the Economic Liaison Committee and served until June 1, 1920. Later he collaborated in the preparation of the Shipping Board report on the fuel oil supply. He was contact man on international petroleum matters with the State and Commerce Departments and made a study of the whole subject for the Bureau of Mines. He recently prepared a booklet on the raw material situation in the United States for the United States Chamber of Commerce.

Heads of other divisions of the Bureau of Foreign and Domestic Commerce, announced recently by Secretary Hoover, are as follows:

Leather division, Arthur Butman, of Boston; transportation, F. S. Gregg, Galveston; textiles, Edward T. Pickard, New York; industrial machinery, Walter H. Rastall, Dayton; agricultural implements, George B. Bell, Jamaica, N. Y.; foodstuffs, E. G. Montgomery, Ithaca, N. Y.; electrical machinery, R. A. Lundquist, Minneapolis; rubber, P. L. Parmerton, New York; iron and steel, W. S. Tower, New York; commercial law, Archibald Wolfe, New York; lumber, Axel Oxhoma, San Francisco, and automotive division, Gordon Lee, Rochester, N. Y. Other divisions are to be added, including chemicals and specialties.

The bureau's five geographical divisions will be conducted as follows: Eastern Europe, under E. Dana Durand, of Romeo, Mich.; Western Europe, Allan G. Goldsmith, Milwaukee; Latin America, Thomas R. Taylor, Hammonton, N. J.; Near East, James A. Robertson, New York, and Far East, Frank R. Eldridge, of Takoma Park, Md.

With the completion of the organization of the new divisions, all of the important industries of the country are now placed in direct touch, through the medium of the new industrial division heads, with the hundreds of foreign commercial agents of the United States who are busy digging up new trade opportunities and extending foreign commerce in every corner of the world.

BAD YEAR FOR PROPHETS AND PROFITS IN THE OIL BUSINESS

By Robert S. Ellison
Vice President, Midwest Refining Co.

AS FALL APPROACHES, it is only natural that those interested in the oil industry should endeavor to forecast its probable trend in 1922. However, being neither a prophet nor the son of one, the writer of this article makes no pretense of unveiling the future.

The writer recalls all too vividly the feeling and conviction one year ago of a great majority of oil men that more production—a great deal more production—was imperative to avoid an impending world shortage of both crude and refined oils. The rapid decline in the price of crude in 1921 is positive evidence that such shortage still impends, if such conviction is well founded, for we have had no shortage this year. Personally, I believe the industry generally faces such a shortage, but doubt if anyone can state with authority that one, two or three years will bring us face to face with it.

ROBERT S. ELLISON

We do know that the winter of 1920–1921 saw an ever increasing development of both new oil fields and deeper producing sands in old fields; that apparently the world over the search for additional crude was pressed day and night, almost regardless of expense. We know that new refineries and additional facilities flourished and grew apace. Nature usually requires after strenuous efforts, however, that a rest or breathing spell follow. As a matter of fact, economic laws, such as supply and demand, are somewhat analogous, to say the least, to the laws of nature. What could be more natural, therefore, than that the year 1921 be a breathing spell after the orgy of 1920?

Whether the bringing in of new fields or deeper productive sands, the inability to pay for exports from this country by impoverished peoples abroad, coupled with unfavorable exchange rates, or whether the shutdown of factories and the severe readjustment of our great agricultural industry led to these conditions, is not of vital importance. Certainly, we are all aware that lack of orders for refined oils in the winter and spring of 1920–1921 resulted in the accumulation of such enormous quantities of refined oils at our refineries that we faced an over-production of crude.

It is obvious that any moving object or force when halted in haste occasions more or less strain and lost energy. Those not properly equipped or anticipating such sudden halting are bound to be wrecked, or at least be in need of repairs. In the oil industry, such repairs took the form of using both cash and credit to tide over the period of depression, or, where these were inadequate or lacking, by suspending operations in whole or in part. Refiners cut their capacity to the minimum; pipe lines stored crude and prorated runs; producers in many instances suspended further drilling as rapidly as possible and, finally, either in the exercise of good judgment or by force of market and financial conditions, left as much of their crude in nature's reservoirs as could safely be done.

The most noteworthy fact in this connection, perhaps, is that the industry faced this situation almost without warning and unable or not wishing to believe it possible. No doubt the handwriting forecasting the coming of such a readjustment could and should have been read. It seems reasonable now that the oil industry should not be immune from depression when its principal customers are depressed. We realize now that with farmers and manufacturers forced to economize as seldom before, with unfavorable foreign markets for essential refined products, coupled with an ever increasing supply of crude, that the oil industry must inevitably be affected and its increasing momentum checked. That this condition should be deliberately brought about, however, by the large companies for selfish purposes, as is sometimes heard charged, is both incredible and monstrous. The fact that numerous refineries flourished with crude at $3.50 or $4.25 per barrel and suspended when the price in the Mid-Continent fell to $1.00 and less is sufficient evidence to my mind to show our lack of orders during falling prices is due to business depression and curtailment of expense on the part of the buying public. The heavy note and bond issues at high interest rates show definitely how our largest companies have carried on and kept the industry in splendid shape for rapid recovery, provided the settlement of our principal internal and foreign questions is effected reasonably satisfactorily and fairly soon.

Under these conditions, the oil industry approaches what usually is and normally should be the dull season of the year. There is nothing to indicate that the winter of 1921–1922 will be an exception. In fact, many experienced producers, refiners and marketers anticipate an exceedingly dull winter. This may not be an accurate forecast but there are reasons to support it. In accordance with both sound judgment and force of necessity, practically every branch of the industry has been curtailing expenditures not absolutely essential to keep the industry from utter shut-down and chaos. It has taken time to get to such point, but September 1 finds drilling operations materially less than in January, 1921, and the practical, most far-sighted managements content to assist recovery by not burdening the industry with any expenditures not

actually necessary during these times of financial stringency. No quarrel can be found with this policy. It is like the convalescent period of a patient who has been very ill—before restoration to active health, there must be a period of inaction to gather strength and regain steadiness of hand and of head. It may be we are close on to our convalescent period. Much can affect its duration and final outcome, however. Undoubtedly the speedy enactment by Congress of fair and acceptable revenue and tariff legislation and the successful outcome of the armament reduction meeting at Washington in November will be particularly helpful. The prompt readjustment downward of our railroad rates and other operation costs is equally vital. The realization by all employers that labor is not a commodity but a most important element of any organization and as such entitled to fair and just treatment, and by all employes that for them to prosper their employer must prosper and that his interests are theirs, is of vital importance. The political demagogue, the union organizer and the red agitator are now so closely allied that aimless discontent and industrial strife may cripple and delay business recovery. This is not the least, but is only one, of the problems our industries and the nation must handle and solve fairly but definitely. In short, with our own readjustment well under way, we become more and more vitally interested in removing other obstacles in the way of a general business revival. This can be had only, perhaps, when our post war changes are substantially effected and other industries have also been into the depths and again have begun the upward climb.

Personally, it is a source of pride that our industry not only served as a volunteer during the war without either the spur of the draft or the incentive of profiteering to urge it on, and that already it has reduced its costs in line with the requirements today of the public welfare. It is true there have been some outcries in this connection, but history records that in any retreat the camp followers invariably are the hardest hit, while the fighting men maintain their courage and patience until retreat once more becomes attack. The way in which the large companies have carried on the past eight months, so far as my experience goes, shows that they have, without exception, taken their enormous losses in inventories, borrowed funds at high rates, cut out deadwood wherever found and borne the smaller operators' burdens in many instances, as well as their own, without particular complaint.

Necessarily, there is more or less uncertainty, suspicion and distrust in some sections of the industry. The down-and-out operator, stock broker or promoter has to have some excuse other than inexorable economic laws for his present plight, and fear of loss or failure, coupled with natural envy, brings dissensions and differences in our own ranks when united efforts would be most helpful. No doubt this situation will continue until the rising sun of prosperity dissipates the fogs of suspicion and drives away the clouds of depression. Meanwhile, a thorough understanding is most important on the part of every one connected with the industry and, so far as possible, of the general public, that the oil business, like the agricultural, stock raising, gold and copper mining, automobile, textile manufacturing and scores of other industries, has been and is now undergoing a severe readjustment to lower cost levels during 1921, and that whether we like it or not it is necessary to a healthful business and a permanent future. It is important, in my judgment, that this fact be known by our citizenship generally and that the glamor of getting rich quickly be torn from the oil business. If not, the future promises a fruitful crop of adverse tax and other legislation which will aim at and penalize our industry and delay our return to normal prosperity. This is a duty we owe our business and country. The harder hit we are the more effective our evidence as to the real cause of our trouble. Would this not be fairer and better business than to direct our envy and malice at our stronger neighbor and thus counteract his efforts to uphold and stabilize the industry and also sow the seeds of unfair legislation which will restrict our future and affect each of us disastrously? This may be ill-sounded reasoning, but I believe in some respects at least the statement does not bring out with sufficient emphasis the dangers which actually threaten.

Of course, no one can be expected to aid or abet any concern which deliberately refuses to carry its full burden today but, on the contrary, is seeking to gain an unfair advantage at the expense of its neighbors. Just criticism of such methods should not be repressed, and no unfair action should be condoned. We should endeavor to act during these times of stress along the same lines of fair play and co-operation as in the sterner days of the war.

A possible danger may lie in permitting any present differences in our ranks to pass the bounds of healthy rivalry. For instance, those of us not directly interested in the levying of an import tax on crude oil can see more clearly than the producers interested in the Mid-continent or Mexican fields that there is a larger question at stake in the long run than the mere import tax on Mexican crude. We are convinced that foreign competitors, backed by government aid, may secure control of the potential oil production of the future unless the American producers with the active support of our government utilize our experience and prestige to maintain our present leadership.

It is true that many oil men are disposed to press their production without thought of the needs of tomorrow, but in dealing with a commodity as vital as is petroleum to all means of transportation and commerce those of us engaged in the industry owe some higher duty to the nation and to our successors than the mere accumulation of present wealth; or, at least, so it seems to me.

It is not wise to forget that petroleum is regarded as a natural resource, and with a government oil and gas leasing law already in force in the public land states that the tendency toward government control requires small impetus these days. The benefits of a government mandate over our railroads are not sufficiently obvious to welcome further supervision from that source, but unless the industry maintains a united front and solves its differences fairly in its own councils, the blighting hand of adverse legislation and governmental interference will ultimately deprive the business of both pleasure and profit.

The quality of our leadership and the character of our rank and file, however, argues well for the future of the petroleum industry, and having touched bottom in the first eight months of 1921 we can look forward with more assurance to rising prices in 1922.

OIL INDUSTRY CAN CONTINUE TO MEET ALL DEMANDS MADE UPON IT

By H. G. James

IT IS PROBABLY a true statement that never before in the sixty-two years of the oil industry in this country has there been witnessed such interest in petroleum for fuel purposes.

This is probably due to three things:

1. A realization, at least on the part of the public, that petroleum is not a fleeting commodity.
2. An unquestioned supply.
3. Its convenience and safety.

Until recently, all down the years alleged authorities have insisted that within a given period crude oil would become exhausted. During the war it seemed to be necessary, in order to spur the wild-catter to go forth and drill, to carry the impression that oil was likely to become exhausted and that every effort should be made to produce enough to win the war.

In the matter of domestic use, designing ones had educated the public to believe that oil was dangerous and that no successful means had been devised for burning oil in the home and public buildings.

All of these fallacies have melted away in the presence of uncontrovertible evidence to the contrary.

It must be taken into consideration that the oil industry, in spite of the fact petroleum had been known for generations, is only sixty-two years old. As an industry petroleum dated from August, 1859. It might be worth while to reflect that only within a comparatively short time has coal been a world-used fuel. It was necessary for coal to await the coming of cheap transportation to bring it into general use. Our fathers gathered driftwood and corded the felled tree for their fuel supply. Our grandparents gathered fagots. Today we are passing from coal to oil where we would have heat with ease and comfort. Oil, like coal, has had to wait the development of conditions favorable to its general use as a fuel.

H. G. JAMES
Secretary and General Manager, Western Petroleum Refiners' Association

Nothing more forcibly illustrates the adequate supply of oil as a fuel than the luminous story told by the record of stocks. In 1914, when the famous Cushing field was at its height, stocks of crude oil in the United States amounted to 141,500,000 barrels. Since then we have passed through the greatest war the world has ever known, with its attendant unparalleled demands upon the petroleum industry, and today we find in excess of 160,000,000 barrels of crude oil in storage, with more great fields in course of development and greater production in prospect, than ever before in the history of the industry. I would call attention to the fact that if petroleum stocks had been reduced during the war as publicly declared there would not have been a barrel in tank at the end of the conflict. The point is made to emphasize the fact that at no time has the ability of the industry to deliver been in danger, and the present predictions of some alleged experts of a shortage in one, two or three years are groundless. If necessity required, it is safe to say the yield of crude petroleum could be vastly increased in a comparatively short time. Oil men are coming to believe that oil can be found practically anywhere the formation is right. Only a small area is required for the development of a "big" petroleum oil field. Ever and anon, rich deposits of oil are being found by the restless prospector where least expected.

Only yesterday came news of a 25,000 barrel well in an entirely new district in Texas. No one can estimate today the potential possibilities of the new field in Arkansas. Wyoming and Colorado yet hold unlimited possibilities, and when necessity requires it will not be surprising if the Northwest is able to produce all the oil the world may need for years to come.

Only yesterday government officials and so-called experts were flooding the press of the country with statements to the effect that oil would soon be exhausted; that consumption was far in excess of demand; yet the fact remains the oil industry went through the extravagant period of the World's War, with demands undreamed of and yet concluded each succeeding year with a greater storage of refined products and greater potential crude output than ever before, and with production today so far exceeding consumption that practically one-fourth of all the refineries in the United States are shut down, others are running 30 to 50 percent of capacity; drilling has been largely curtailed, and the industry is suffering one of the greatest periods of over-production and depression in its history.

We would not leave the impression that the oil industry is irreparably hurt, for it is not. One of the remarkable characteristics of petroleum is that its periods of depression are invariably of short duration. It is a business that rapidly recovers from depression. The thing that I am attempting to emphasize is that there is and has been a sufficient quantity of petroleum to meet all demands, and that there will be indefinitely enough oil to supply the world. Indeed, I wish to show the public it can turn to oil for fuel purposes without fear of a supply.

May we not profitably glance at a few figures in support of this argument?

In 1914 stocks of crude oil amounted to 141,500,000 barrels; in 1921 they aggregated 160,000,000 barrels.

In 1917 stocks of fuel oil totaled 13,759,000 barrels; in April, 1921, 25,154,000 barrels.

In 1918 stocks of kerosene amounted to 380,117,000 gallons; in April, 1921, to 458,666,000 gallons.

In 1918 (at conclusion of war) stocks of gasoline amounted to 297,326,000 gallons; in May, 1921, to 808,551,000 gallons.

And during this period the internal combustion engine, the automobile, the flying machine and the oil burning battleship had their greatest development. The consumption of petroleum the past six or eight years has been little short of miraculous, and yet in spite of various statements and propaganda, production has increased more rapidly. Today it seems as if "they were finding oil everywhere."

Comparisons are said to be odious, yet we will probably admit they are usually interesting. For instance, the output of bituminous coal in the United States in 1917 was 551,790,563 tons; in 1920, 556,563,000 tons, a gain of 8/10 of one percent.

In 1917 the yield of fuel oil in the United States was 149,724,279 barrels; in 1920 the output was 210,986,903 barrels, a gain of 41 percent.

It should be borne in mind that during this same period the production of crude or raw petroleum increased from 325,315,601 barrels to 443,402,000 barrels.

Our excess supply or stocks of gasoline (motor fuel) in July 1918, aggregated 345,000,000 gallons, and on July 1, 1921, 752,668,000 gallons. And yet during that time automobiles increased in number with almost incredible rapidity.

We admit the petroleum industry has proved its ability to perform.

Indeed, the industry has grown so rapidly even those in it are unable to appreciate its wonderful progress.

Now the question arises "Can the oil industry continue to meet the demands upon it?" In my mind, unquestionably yes. It is true people by the thousands are turning to oil as fuel in the home, public buildings and in the shop and factory; the railroads are using oil more generally, more battleships are being built to use it. But I am afraid there is more likelihood of a limit to consumption than to the supply. Statisticians are already at work figuring on just how many additional automobiles the country is capable of buying. Remember we must have a normal increase of about 20,000,000 barrels of crude oil to keep pace with the normal and natural increase in output.

The thing the oil industry is worrying over is a market, not a supply. The oil fraternity is afraid of imports from countries where the potential supply of oil is almost unlimited. For a third of a century I have been "playing" with oil statistics and never have I been more convinced of the ability of the industry to meet every and all demands made upon it than now.

OIL SHALE—A POTENTIAL WORLD WIDE INDUSTRY

By Victor C. Alderson
President, Colorado School of Mines

OIL SHALE DEPOSITS are world wide in extent. Interest in them is almost universal. The deposits in Colorado, Utah, Wyoming, California, Nevada, Idaho, Montana, Kentucky, Indiana, Scotland, England, and France are now well known. Information of new deposits and fresh activities are constantly coming forth; e. g., new and extensive deposits are reported from Colfax County, New Mexico, from Terrell and Val Verde counties in Texas, and from the Upper Yukon valley in Alaska.

In Italy deposits are reported in the provinces of Como, Breacia, Udine, Vioenza, and Salermo. An Italian company has been formed to distill oil from the Sicilian bituminous shales. The process has been developed by Italian engineers. In 1920, 5,000 metric tons of shale were treated. An oil refinery, at Rome, is now planned.

The presence of oil shale deposits in Germany was well known before the war, but no serious attempts were made to develop them. The scarcity of oil during the war, however, called attention to them and effective exploration was begun, with the result that the deposits were found to be more extensive and richer than was supposed. The main deposits are in central and southern Germany, in Saxony, at Messel near Darmstady, but particularly at Rentlingen, in Wuerttenberg. Here tests gave 250 litres of oil to the cubic meter of shale. From the Jura mountains in Bavaria oil shale is also reported. A new German corporation "Bayrische Mineralcal Werke" has been formed, with state and national support, to develop the deposits and to erect retorting and refining plants. Before the war Germany depended upon importation for her supply of oil. The exigencies of the war taught her the importance of a domestic supply. Since the close of the war she has pursued a systematic development of her oil shale deposits in order to be free from the uncertainties of oil importation. The value of oil shale as a source of oil is clearly seen and intelligently acted upon.

In Spain oil shale deposits occur in the provinces of Castellon, Ternel, Burgos, Seville, and Soria. Tests thus far have not resulted in commercial operations.

In the Philippine Islands, oil shales are reported to occur in several districts, especially on the Boldoo peninsula, Tayabas Province, Luzon. The resulting oil has a paraffin base and is virtually free from sulphur.

Bulgaria has no oil wells but has extensive deposits of oil shale. For this reason the production of oil from shale has received special attention from the government and three concessions have been granted for developing the deposits. These deposits are five in number:

1. Breznik. The deposit is about 20 feet thick, yields 13 percent of oil, and is estimated to contain thirty million tons of shale. A test of this shale in Glasgow showed, in comparison with Scotch shale, a lower percentage of kerosene, gasoline, and ammonium sulphate, but a higher percentage of benzine, lubricating oil, and paraffin.

2. Hadomir. These deposits are even greater than at Breznik and are 12 miles in length. Samples have been studied in Berlin and found to yield 8 percent of crude oil.

3. Popovtzi. This deposit is only one mile from Papovtzi, and extends for five miles along the railway. Tests made by the government showed on the average from 7 to 13 percent of crude oil but the best results came from shale near the village of Sirbinovo which yielded 21 percent of oil.

4. Kazanlik. These deposits average 30 feet in thickness.

5. Sirbinovo. These deposits are about 80 feet thick. The quantity seems to be almost unlimited. Bulgaria

has great potential wealth in her oil shale deposits, which, when developed, will give her a domestic supply of oil sufficient to supply her industrial needs.

In Norway, oil shale deposits are found on the island of Auden, in the northern part, where they are closely associated with coal deposits; also at King's bay on the island of Spitzbergen. In Sweden, the chief deposits are at Kinnekulle, Nerike, and Ostergetland, which have been estimated by a Royal Commission to contain five billion tons of shale. The Sweden Shale Works Company reports that it is treating 100 tons of shale a day at its plant at Hidings and is obtaining an excellent fuel oil which meets competition with other kinds of fuel.

The most varied economic use made of oil shale is, curiously enough, one of the direct results of the great European war. In 1916 the Russian Government needed fuel and turned to the oil shales of Esthonia—then a part of Russia, but now one of the new independent Baltic states—and made an exhaustive and systematic examination. It was found that these deposits formed the only great potential resource of Esthonia. After the organization of the new state, the government took active steps to develop the industry, till today, in Esthonia, the use of oil shale is more varied and more successful than anywhere else in the world, not excepting even, Scotland.

"Kukersit," the local name for oil shale from Kukers where it was first discovered, outcrops along the Gulf of Finland in steep cliffs. It dips slightly to the south, about one degree, so that it remains near the surface for long distances and can be mined cheaply by open cut work. The workable deposit extends from Jewe to Wesenberg, a length of 60 miles, and is six miles wide. The immediate available supply is known to be virtually a billion and a half tons. Analysis of good "kukersit" gives, on the average the following results:

Moisture	3.74 percent
Hydrocarbons	61.42 percent
Coke	7.68 percent
Ash (plus CO_2)	27.00 percent
	100.00 percent

From repeated tests sulphur, in the best grades, has been determined as follows:—

Total sulphur	3.48 percent
Volatile sulphur	0.43 percent
Constant sulphur (in ash)	2.05 percent

DR. VICTOR C. ALDERSON

The shale is subjected to low temperature distillation and yields the usual products which are really solid. Nowhere else is there so wide a use made of the shale itself and its products as in Esthonia. As fuel the shale is used in a variety of ways; viz., in firing locomotives, in the Reval gas factory for the production of gas where more than four million pounds have already been used: in Port-Kunda cement factory, where more than two million pounds have been used: under stationary boilers where the arrangement allows easy handling of the large amount of ash: cooking stoves, open grates, and similar domestic uses: on steamers, and in the burning of lime. All this use is made of the crude shale besides its use in the retort, from which are produced the oils, paraffin, and coke. The chief production of shale is at the Government mine at Kochtel, where the surface improvements consist of a central power station, ware houses, depot, offices, and houses for the officers and men. In 1920, 50,000 tons were produced and 500 men employed. Recently steam shovels were put into use so that the production could be largely increased. The government has opened a second mine at Port-Kunda, to still further increase production. Inasmuch as "Kukersit" comprises the greatest natural resource of Esthonia and the government is bending every energy to develop it, the progress made will be watched with more than usual interest.

South America

Brazil, one of the largest countries in the world, with a stable government and an enterprising people, with a great variety and wealth of natural resources, especially excellent iron ore, is dependent upon foreign sources for fuel—coal and oil. Fortunately the deposits of oil shale are found in abundance in several places, especially along the coast from the Amazon river on the north nearly to Rio Janeiro on the south. The deposit is exposed at intervals throughout the entire distance but is particularly well exposed for a distance of 400 miles in the state of Alagoas where it is known to extend for two miles back of the outcrop. Near Maceo, in Alagoas, experimental work on retorting is now being done. The late Sir Boverton Redwood reported this shale to yield 44.73 gallons of oil to the ton. With little or no coal or petroleum, Brazil naturally looks to oil shale as a valuable resource. The rapid development of the oil shale industry in Brazil, therefore, may be confidently expected.

Argentina contains numerous undeveloped oil shale deposits of which the Rio Grande, 240 miles from Alvear, on the Western Railway is the most important. The outcrop has been traced for twenty miles. The deposit is known to extend a mile and a half back of the outcrop, and has an average thickness of 100 feet. Like Brazil, Argentina has few deposits of fuel so that oil shale, when developed, is likely to be her main domestic source of fuel.

South Africa

The oil shale deposits of South Africa are recognized in four well defined areas: viz., the Ermelo district of the Transvaal; the Wakkerstroom district of the Transvaal; the Utrecht district of Natal; and Impendhle county of Natal. The oil shales of the Ermelo district occur in three veins; the lowest has a thickness of 20 to 24 feet; the middle one, 19 feet; and the top one from two to three feet, with some very thin streaks. Unfortunately, the lowest and middle veins produce little oil. The top vein yields 30 gallons of oil and 64 pounds of ammonium sulphate. Only a small amount of prospecting has been done so that the actual value of the

field is not known. The thinness of the top vein should not alone bar the district from consideration because the district is crossed by the Broyton-Ermolo railway and therefore has better transportation facilities than any of the other oil shale districts.

The main bed of the Utrecht district has a maximum thickness of 22 feet, composed of a series of beds from two and a half to five feet in thickness. These beds are not uniform throughout the district, but, in places, thin out and enlarge. A test of the shale at the City Central Laboratory, London, gave 40.6 gallons, 57 pounds of ammonium sulphate to the ton; and 1.71 per cent sulphur. The distance of this deposit from a railroad is disadvantageous but other advantages would probably justify a branch railroad from Wakkerstroom.

The oil shale deposits in Impendhle county, Natal, occur in the Molteno beds and are best exposed on Crown lands in the Umkomas valley. E. H. Cunningham-Craig, of London, reports this shale to yield 27.10 gallons to the ton. Little development has been done but what has been done indicates a valuable deposit worthy of further consideration.

In the Wakkerstroom district, the oil shales are found chiefly on four farms: viz., Kromhoek, No. 76; Virginia No. 371; Goedgeronden No. 77; and IJzernoyu No. 280, thirteen miles from the city of Kromhoek. The deposit has been opened for a distance of three miles by open cuts 200 yards apart, sufficient to show the full section of the deposit with roof and floor. Until recently control has been held, and development made, by the African Oil Corporation, Ltd. A test of the shale at the Pumpheraton Works in Scotland gave 31.75 gallons of oil and 37.18 pounds of ammonium sulphate to the ton. The test also showed that the Scotch retort was suitable for treating the shale. Recently the Royal Dutch Shell interests, after a favorable report of their engineer, have taken a six month's option on the property of the African Oil Corporation. The advent of this company into the oil shale industry is an epoch making event as it assures development and financing on a worthy scale. Also it shows appreciation by those interested in oil production from wells, that, in the future, they must depend upon oil shale as the source of oil.

These interests are also examining the Sakalava oil shale deposits in Madagascar.

In other parts of South Africa oil shale deposits are reported; e. g. in the beds of Basutaland; in the so-called Black shale group in Southern Rhodesia; and in the Matatiele Division of Griqualand East, Cape Province. A test of this shale, made in the Government Laboratory at Cape Town, yielded 25 gallons of oil to the ton.

The absence of a domestic supply of well petroleum, the consequent importation of oil and oil products, and their high price, a large local demand the presence of substantial deposits of oil shale, all followed by the active interest of such a colossus of financial strength as the Royal Dutch group combine to indicate an early development of the oil shale industry into a successful commercial basis in South Africa.

Australia

Oil shales occur at various places in Queensland on Munduran creek near Gladstone, on Casuarnia island, Redbank Plains in the Ipsqich district, and on Murray's creek near Toowoomba. The deposit at Duaringa, on the Central Railway line, shows a thickness of six feet and yields 30 gallons of oil to the ton. At "the Narrows" the deposit extends for sixteen miles along the outcrop and inland for a distance from one to two miles. On Curtis island the deposit occurs between Badger and Monte Cristo creeks. Shale from the Munduran company holdings gave 28 gallons of oil and 47 pounds of ammonium sulphate. The most promising deposit in Queensland is in the Port Curtis district, reported by Lionel C. Bell, government geologist. Two beds, 10 and 9 feet thick, respectively, yielded 38 gallons of oil and 29.6 pounds of ammonium sulphate to the ton; sulphur one percent. A sample tested by Ronald Johnstone & Son, of London, gave 45 gallons of oil and 21.90 pounds of ammonium sulphate to the ton; sulphur 0.57 per cent. These deposits are well worth systematic development and exploitation.

The best known deposits in Australia are in New South Wales. The local name of "kerosene shales" is inaptly applied, as the deposit has the characteristics of the English "Torbanite" material, yields a very high percentage of volatile hydrocarbons (89 percent in pure samples) and does not split in parallel layers, but has a conchcidal fracture. The discovery of oil shale in New South Wales was made as early as 1803 but was not formally noted till Count Strzelecki, in 1845, described it in his book, the "Physical Description of New South Wales." Commercial production began in 1865, with 570 tons. The total production from 1865 to 1919 was 1,840,876 tons of a value of 2,502,813 pounds sterling. At Joadja the earlier operations were conducted by the Australian Oil and Mineral Company, but a newly formed company—The Shale Petrol Oil Co., Ltd.—has taken the property. Recent developments consist of 200 feet of tunneling, two miles of new road, a retort, and a storage tank of 30,000 gallon capacity. The deposits at Newnes have been known and worked for many years, but the results of the Commonwealth Oil Corporation were disastrous and a receiver appointed. John Fell has revived the company, installed new retorts, and put the company on a commercial basis. The trouble seems to have been not a supply of shale nor a method of treatment, but inability to secure labor of the proper type. These troubles are now over and success seems assured. A new mine with eight working faces has recently been opened. The shale yields on an average 80 gallons to the ton. During the year ending June 30, 1920, the company received $81,460.00 as bounty on oil produced. A sample of oil shale from New South Wales tested at the Colorado School of Mines yielded 140 gallons of oil to the ton of 2,000 pounds.

In Tasmania oil shale, locally known as "Tasmanite," is found in the Mersey district. It occurs near the surface in beds up to 12 feet in thickness, yields 40 gallons of oil to the ton, and is estimated to contain twelve million

tons of shale. A company of English and Australian capitalists has recently acquired interests near Latrobe and is planing to erect a plant of 100,000 tons annual capacity. A sample of Tasmanite, tested at the Colorado School of Mines, gave 68 gallons of oil to the ton. Besides the deposit of Tasmanite, there is a deposit of rich kerosene shale, similar to that of New South Wales, at Preolenna.

The oil shale deposits in New Zealand have been examined and favorably reported upon by the engineering firm of Ronald Johnstone & Son of London. These deposits are in the county of Wallace adjoining the township of Orepuki and are owned by the New Zealand Coal and Oil Company. Prospecting by diamond drilling showed four veins of shale, each between four and five feet thick, and an available tonnage of a million tons of shale. A test on 57 tons of shale, made in Scotland at the Pump horston Works, gave 38.41 gallons of oil and 19.12 pounds of ammonium sulphate. The fractionation of this oil gave:

	Percent
Kerosene	25.92
Gas oil	3.07
Medium oil	4.05
Lubricating oil	17.55
Hard paraffin, four percent of oil (melting point 119.5)	19.03
Soft paraffin (melting point 86.5)	1.08
	70.70
Loss in refining	29.30
	100.00 percent

These deposits are, on the whole, of commercial importance, can be operated at a profit, and are deserving of exploitation and development.

Canada

In the province of Sackatchewan, Canada, two hundred leases on oil shale land covering an area of 130,944.81 acres have been issued. The oil shale deposits of the Pasquia hills are reported to be of commercial value both in oil and ammonium sulphate. Along the valleys of the Matagami, Moose, and Abbitibi rivers, in northern Canada, the discovery of oil shales in commercial quantities is announced by the Canadian Government. Shale from the Abbitibi river gave 87.36 gallons of oil to the ton. Other samples yielded as much as 123.2 gallons to the ton. Samples of shale from Newport Islands, County of Gaspe, Quebec, submitted by R. E. Lenthall were tested at the Colorado School of Mines and yielded 22.24 and 51½ gallons of oil to the ton. Oil shale deposits on Graham Island, Queen Charlotte Islands, are reported but only preliminary prospecting has been done.

The potential value of the oil shales of Newfoundland is very great. The deposits cover an area of 750 square miles, the largest of which lies between the head of White bay and Deer and Grand lakes. Here the thickness ranges from 50 to 100 feet. Average shale yields 50 gallons of crude oil and 80 pounds of ammonium sulphate.

The "Stellar" oil shale deposit at Pictou, Nova Scotia, covers an area of ten square miles and contains five hundred million tons of available shale. For economic working the deposit is ideally situated, in the center of a manufacturing region, with convenient rail and water transportation, ample water supply, and a good local market. The deposit has been examined by prominent engineers and scientists like Williams, Miller & Robertson, Edinburgh; Sir Boverton Redwood; Dr. A. E. Dunstan of London; and Dr. A. E. Hunter of Edinburgh. Their reports have been exceedingly optimistic. One third of the deposit, averaging 24 feet thick, that can be worked by open cut methods, is estimated to yield one hundred million tons of shale. One seam that averages 40 gallons of oil and 79 pounds of ammonium sulphate contains thirty million tons of shale. Beyond question this deposit is worthy of economic development.

The oil shale deposits of New Brunswick have been known since Dr. Albert Gesner, in 1851, distilled oil from the Albertite of the Albert mines at Baltimore, now Rosedale, but the discovery of flowing well petroleum in Pennsylvania snuffed out the life of the budding industry. Time and again attention has been called, officially and privately, to the importance of developing this oil shale deposit in New Brunswick till at last the British Government itself, through the Anglo-Persian Oil Company and the D'Arcy Exploration Company, has become practically and financially interested in developing the shale and experimenting upon the retorting and refining processes. An experimental retort of the Wallace type of eight tons daily capacity has been erected with satisfactory preliminary results. During the present year a drill hole has been put down for 1005 feet of which 940 feet was in oil shale and the bed had not been passed through. Other drillings amount to 17,000 feet. The most conservative estimate of the yield is that of Sir Boverton Redwood, 32.7 imperial gallons. With a virtually inexhaustible supply of oil shale, a promising process of retorting, with local interest like that of Lieut. Gov. Pugley and Matthew Lodge behind the project, and the financial support of Great Britain, the outlook for a successful result could hardly be improved.

A comprehensive and world-wide view of the situation suggests a few striking facts.

1. The supply of well petroleum cannot be depended upon to supply indefinitely the needs of industry and advancing civilization for oil and its derivations.

2. The oil shale deposits throughout the world are virtually inexhaustible and supply a "second line of defense" as it were.

3. The main problems to be solved are:

   (a) The perfection of a retort of large capacity, foolproof in operation, and designed on correct scientific principles, that will produce the maximum amount of good oil.

   (b) The refining of the crude shale oil, not into a long list of chemical curiosities, but into a few standard products for which there is a steady market, and,

   (c) The co-ordination of the various elements so that as a business project the whole will be an economic success.

4. There is a world wide interest in oil shale—financial, economic, technical, chemical, and practical—that augurs well for its early development into an important factor in the economic advancement of the entire world.

MAKING THE BIGGEST AND COSTLIEST MAP IN THE WORLD

By Guy Elliott Mitchell,
Of the U. S. Geological Survey

THE GREAT TOPOGRAPHIC MAP of the United States which is nearly half completed will be the hughest and the most costly map in the world. It will also be the most refined and detailed. Millions of dollars have already been spent on this big project which ranks as an engineering job of first magnitude, and as the years go by will have much to do with fostering the full development of the United States. For the past forty years the United States Geological Survey has prosecuted this work of mapping the country from end to end, searching out every nook and corner of its wonderfully diverse physical surface and faithfully transmitting it to paper. When it is completed the map will be about 3,000 inches wide, but as it is considered that this would be somewhat inconvenient for pocket use, the map is being published piecemeal. As soon as a section or "quadrangle" is surveyed the corresponding sheet is published. Thus far some 3,000 quadrangles have been surveyed and the maps issued.

A topographic map is unique in that it is covered with contour lines, and contour lines are level lines of elevation. These contour or level lines are interesting and useful to the hiker, the camper, the prospector, the hunter and the fisherman, and the transcontinental railroad engineer, or to anybody who goes abroad through the country, for they not only portray the shapes of all the hills, mountains and slopes but they constitute a complete dictionary of altitudes for every named and unnamed point. Place your pencil on any point on the map and in ten seconds you can determine the altitude of that point, be it mountain peak, knob, gulch, or any place on or off the trail, wherever you may happen to be. The contour lines always follow levels, winding in and out of every inequality of the land surface and showing every detail of topography, every physical feature.

The cost of surveying and engraving a map of one of the standard quadrangles, comprising about 225 square miles, ranges from $3,000 to $8,000, according to the character of the country surveyed, but the individual map is sold by the Geological Survey at ten cents a copy, a price very little more than the cost of paper, printing and distributing. Of course only the government can do this. Were the map produced by a private firm it would be necessary to charge $5 a copy for it. Even so the map would be easily worth it and engineers at least would pay double that for it.

If you have ever had the pleasure of visiting any of the camps of the Geological Survey field parties where unmapped areas are being surveyed, you will appreciate the topographic map. The work is very interesting, even to a non-technical man, and it is characterized by its absolute thoroughness and exactness. The topographic maps made by the United States Geological Survey are, I think I can say without contradiction, the finest maps in the world. Most of them are made on the generous scale of one-mile to one inch, a scale that enables the topographer to put almost everything on the map which can be seen on the ground. The ordinary big wall map of the United States—a map about seven feet wide—is on the scale of forty miles of land surface to one inch of map paper. It is obvious, therefore, that one mile to one inch is a large scale.

IN THE MISSISSIPPI LOWLANDS
Dense growth must be cleared away before mapping party can make use of their instruments

A good engineer in the field will survey and put on his map one square mile in a hard day's work. That square mile will cover one square inch of the map; but in that small space will be shown by means of the finest hair lines and lettering every important physical, natural and artificial feature which that square mile contains.

Should you have any suspicion that these maps are not made carefully and with scrupulous accuracy, look into the matter yourself. The experience may be interesting, too. Take the trail for one of the topographic field parties in the mountains; drop in on any of them and go out with the topographer in the morning, just after daylight, and see how he does it. He will show you some instrumental surveying—the determination of distances and altitudes—that constitutes one of the most fascinating and entrancing jobs in the United States. And the result is the incomparable topographic map, which, later, after it has been inked, is engraved on copper and then printed from stone in three colors by the Geological Survey's lithographic plant.

Now you may also visit or imagine the engraver in the Washington office, carefully and painstakingly cutting each line of the engineer's original map, on a copper plate

THE TOP OF THE UNITED STATES
Mount Whitney, 14,501 feet above sea level. Surveyor has built a monument on the summit, thereby adding seven feet to the apex of the country

—representing miles and miles of contours and streams and roads and trails and bridges and houses and everything else you can see on the ground. He can of course cover more than a square mile, or rather a square inch a day, as the engineer does, but yet a difficult mountain sheet may take the engraver three months to complete.

The topographic map, as you will gather, is in no part a compiled map; it is made on the ground and everything that is on the map has been put there by the engineer with the original before his eyes. Now after the strenuous work in the mountains, during the open season, reducing the peaks and the valleys and the slopes to paper, the topographic engineer at the end of the field season when the land is wrapped in snow sits at his desk and inks in his sheet, so that it may be engraved and reproduced. This is a work of delight. As with India ink he traces over very hard penciled marks and lines he lives over every incident of the trying work of the past season, except that now only the pleasant phases are recalled, for nine-tenths of us are optimists and we forget the rough spots. Finally, he turns in what is nothing less than the original masterpiece, to be engraved and printed, which will prove a basic map, a "mother" map, for every class of engineering, from the simplest to the most complex, and for all time. There is just one other thing that should not be omitted. From the time the engineer has gotten half a dozen days' work on his precious sheet, he guards it as he would a pot of gold. He sleeps with it at hand; if he goes anywhere on Sunday he takes the map with him. He takes no chances of fire, or theft or somebody else's carelessness. In the Washington office, when inking it, and when he steps out to lunch, he thrusts it into the big fire-proof safe. As soon as it is completely inked, before engraving, it is carefully photographed, and copies are distributed and deposited in various places. Not till then does the engineer feel safe with his little five- or six-thousand dollar piece of paper.

HEADED FOR FARTHEST NORTH
Crossing Alaska with a pack-train. Mountains, swamps and icebergs are treated alike by the Topographical Engineers, who must know, literally, "every inch" of the country

So if any of you are contemplating going outside of the front yard, I urge you to get a topographic map of the region you intend to visit. It will prove a constant pleasure and a delight; and maybe it will keep you from getting lost.

THE NATIONAL RESEARCH COUNCIL

Its Services for Mining and Metallurgy

By Alfred D. Flinn

"Original research, however, is not a science; it is not a collection of laws. It is an art, because it is composed of rules which must be followed. It is the method of finding new truths of nature by study, observation, travel, or other means. The art of research is based upon the laws and principles of nature, and upon the relations of the human mind and senses to the external world. Nature on the one hand, and the human faculties on the other, are the only agents concerned in scientific research. Original discovery has its origin usually in the love of knowledge for its own sake, and in a desire to confer its benefits upon mankind."—G. Gore, LL.D., F. R. S., in "The Art of Scientific Discovery," London, 1878.*

ENGINEERS AND BUSINESS MEN connected with mining and metallurgy will please accept for the purposes of this article the dictum that research in the sciences is the continuingly prolific origin of progress in our modern industries. Many will grant that research for fundamental truth, regardless of its immediate application to industry, must be carried forward with increasing zeal, lest our progress be stalled. This effort must go forward in spite of the fact that many searches appear to produce no immediately utilizable results. In order that ineffective efforts and consequent losses may be minimized, it grows increasingly important that research should be done by thoroughly trained men. There should also be efficient means for co-operation and for exchange of information among men engaged in research, and between them and the men devoted to the numerous branches of technology. To aid in satisfying these needs, the National Research Council exists. The Council's functions are to stimulate, suggest and promote research in the sciences, to assist research men, to further the exchange of information, especially among groups working in various scientific fields, and to establish liaisons among scientists, technologists and managers of industry.

ALFRED D. FLINN
Vice-Chairman, Division of Engineering, National Research Council

Established in 1916 by the co-operation of scientific and engineering societies and the Engineering Foundation with the National Academy of Sciences, the National Research Council performed many special services during the World War, of great value to our country and its Allies. The Research Council was organized under the federal charter granted to the National Academy of Sciences in 1863. On May 11, 1918, the president issued an executive order which gave permanence to the Council and provided for the co-operation of the governmental departments. The National Research Council, however, receives no pecuniary support from the government, although during the war the government provided funds for some of the work which the Council did for the government.

Financial support for the National Research Council comes wholly from private funds provided by endowed foundations, scientific and technical societies, industrial organizations, and individuals. In December, 1919, the Carnegie Corporation of New York voted to the National Academy of Sciences for the National Research Council the sum of five million dollars to become available July 1, 1922. Of this gift not to exceed one-quarter may be used for a building, and the remainder is to be an endowment, the income from which is to be used for the current expenses of the Council. A condition precedent to this gift was the purchase of a suitable site for the proposed building by means of funds obtained from other sources. This condition was met by procuring a large plot of ground in Washington near the Lincoln Memorial, bounded on all sides by streets. From the land purchase fund, a balance remains on investment providing income for perpetual upkeep. Plans for the building have been drawn by Mr. Bertram G. Goodhue, architect, of New York, and preparations for construction are well advanced. This building will be a dignified, beautiful and practical structure, appropriate for the permanent home of the National Research Council and the National Academy of Sciences. Pending the construction of its new building, National Research Council occupies as its headquarters the building at 1701 Massachusetts Avenue.

The scope of activities of the National Research Council as now organized, is the "promotion of research in the physical and biological sciences and the encouragement of the application and dissemination of scientific knowledge for the benefit of the nation. The Council is neither a large operating scientific laboratory, nor a repository of large funds to be given away to scattered scientific workers or institutions. It is rather an organization, which while clearly recognizing the unique value of individual work, hopes especially to help bring together the scattered work and workers and to assist in co-ordinating scientific attack in America on large problems, especially those which depend for successful solution on the co-operation of several or many workers and laboratories, either within the realms of a single science, or different realms, in which various parts of a single problem may lie. It particularly intends not to duplicate nor to interfere with work already under way. It hopes to help maintain the morale of devoted isolated investigators and to stimulate

* A copy of this book was recently sent to Engineering Foundation and Engineering Societies Library by Sir Robert A. Hadfield, the recent recipient of the John Fritz Medal for the invention of manganese steel, with the following autographed note on the fly-leaf: "This book of Gore's has always possessed a fascination for me and I have been fortunate to obtain a copy, as it is now quite scarce. I send it with my best wishes.—June 29, 1921."

renewed effort among groups willing but halted by obstacles. It will try to encourage the interest of universities and colleges in research work, and the training of research workers, so that the inspiration and fitting of American youth for scientific work may never fall so low as to threaten to interrupt the constantly needed output of well trained and devoted scientific talent in the land." (Fifth Annual Report.)

For accomplishment of the purposes stated, the Council is now organized in six divisions of General Relations and seven divisions of Science and Technology, under the general direction of an executive board. The form of organization is so flexible that it may be and is being adapted, from time to time, to meet the varying requirements of the societies and industries which the Council seeks to serve.

Divisions of General Relations

		Chairman
I.	Division of Federal Relations	Charles D. Walcott
II.	Division of Foreign Relations	Robert A. Millikan
III.	Division of States Relations	John C. Merriam
IV.	Division of Educational Relations	Vernon Kellogg
V.	Division of Research Extension	Harrison E. Howe
VI.	Research Information Service	Robert M. Yerkes

Divisions of Science and Technology

		Chairman
VII.	Division of Physical Sciences	H. G. Gale
VIII.	Division of Engineering	Comfort A. Adams
IX.	Division of Chemistry and Chemical Technology	F. G. Cottrell
X.	Division of Geology and Geography	E. B. Mathews
XI.	Division of Medical Sciences	Victor C. Vaughan
XII.	Division of Biology and Agriculture	L. R. Jones
XIII.	Division of Anthropology and Psychology	C. E. Seashore

As now constituted, the chief purpose of the Council is to organize scientific effort, to survey and collate, and to initiate, promote and stimulate research in science and its useful applications. The membership of the Council in its divisions consists of representatives officially designated by leading scientific and technical societies of national scope, representatives of the govrenment, representatives of other particular research organizations, and members at large chosen by the divisions.

The chairman of the executive board is Dr. John C. Merriam, who is also President of the Carnegie Institution of Washington. The permanent secretary is Dr. Vernon Kellogg. Dr. George E. Hale, director of Mt. Wilson Observatory, was the first chairman of the Council and is now its honorary chairman. The vice-chairmen are Dr. Charles D. Walcott, secretary, Smithsonian Institution and president of the National Academy of Sciences; Mr. Gano Dunn, president of the J. G. White Engineering Corporation, and Dr. R. A. Millikan, professor of physics, California Institute of Technology. The treasurer is F. L. Ransome, geologist in charge, section of metalliferous deposits, U. S. Geological Survey, who is also treasurer, National Academy of Sciences. The executive board and the divisions work through committees, of which there is a large number. Membership in committees is not limited to the members of the Research Council.

National Research Council is in effect an "overhead" or advisory organization. The limited funds at its disposal are only sufficient for its expenses. Consequently funds for experimental research or for the support of other projects organized or promoted by the Council must be provided by the interested societies, industrial organizations or individuals, or be secured by special solicitation. The Council can assist in soliciting financial support, but ordinarily it cannot contribute from its own resources.

Among the noteworthy projects which have been financed, or for which funds are being sought by the National Research Council, there may be mentioned, research fellowships in physics and chemistry, research in the fatigue phenomena of metals, tables of physical and chemical constants, highway research, heat treatment of steel, Alloys Research Association, Personnel Research Federation. For the research fellowships, the Rockefeller Foundation contributed five hundred thousand dollars, to become available in equal annual installments during a period of five years. The Engineering Foundation and the General Electric Company each contributed thirty thousand dollars for the support of the Fatigue of Metals research, and other large gifts have been made by the General Education Board, the Commonwealth Fund, the American Telephone and Telegraph Company, the Southern Pine Association, and a number of industrial corporations, for sundry projects.

Records of the actions of the National Research Council are printed in the "Proceedings" of the National Academy of Sciences. Reports on researches and other investigations are published in the journals of the interested societies or in the bulletins of the universities or laboratories conducting the work. The Council publishes bulletins at irregular intervals, which are assembled in volumes of approximately five hundred pages, and a "Reprint and Circular Series" of pamphlets, any of which may be purchased at moderate prices. Many copies of these publications are distributed gratuitously for publicity and educational purposes. A list may be obtained, by request, from the publication office of the National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

Supplementing its publications, National Research Council has made use of special exhibits and lectures for extending interest in research. Exhibits relating to wireless telephony and to gas warfare, besides being shown for protracted periods at headquarters in Washington, were each sent to other cities. Carefully planned publicity through technical and popular journals is also employed in the process of "educating the public." A department has been maintained in the *Scientific American Monthly*, in which accounts of some of the scientific activities of the Council, together with other articles on special phases of science, have been published.

With the financial support of Mr. E. A. Scripps, of California, a Science Service for dissemination by newspapers, magazines, lectures, motion pictures and conferences, of authentic popular information on science has been organized under the joint auspices of the National Research Council, the National Academy of Sciences, the American Association for the Advancement of Science, the Scripps Estate, and a group of professional journals. The editor and secretary is Dr. E. E. Slosson, a well-known writer and scientist, formerly associate editor of the *Independent* (New York), and the manager is Mr. Howard D. Wheeler, formerly managing editor of *Harper's Weekly*. The Science Service has temporary headquarters in the building of the National Research Council.

International relations among scientific organizations have been initiated and fostered by National Research Council. Growing partly out of the war work and partly out of pre-war connections, the international associations will be particularly helpful in those branches of science and technology requiring information gathered by observation in many parts of the world.

So broad are the interests and so extended the connections of mining and metallurgical men, that there is not a division of National Research Council whose work lacks definite usefulness to them at some time or in some phase. A perusal of the annual report of the Council, which can be had on request, would clearly show this fact. Of special interest, however, are the Division of Engineering, Division of Research Extension,

Research Information Service, Division of Chemistry and Chemical Technology, and Division of Geology and Geography. Space limitation precludes even the bare listing of the subjects of importance to the American Mining Congress, which have received consideration by the divisions named. There may be mentioned, simply by way of example: fatigue of metals, heat treatment of carbon steel, substitute deoxidizers, new uses for selenium and tellurium, physical changes in iron and steel below the thermal critical range, pulverizing, Neumann bands, hardness testing, welding, molding sand, ceramics (especially relating to refractories), explosives investigations, organizations of Alloys Research Association, collection of information about research laboratories and scientific personnel, establishment of a service for making sources of information available to inquirers and for answering questions directly, and various geological problems.

National Research Council is closely affiliated with the leading engineering societies and Engineering Foundation, especially through its Division of Engineering. Offices for the latter have been provided in Engineering Societies Building by Engineering Foundation, which contributes also to the financial support of the Division and some of its research projects. Mr. Charles F. Rand, chairman of Engineering Foundation, and a member of the Division of Engineering, is a past-president of the American Institute of Mining and Metallurgical Engineers and has long been active in the Institute's work. While in England with the delegation of American engineers, in June, he was made an honorary member of the Iron and Steel Institute, the Institution of Mining and Metallurgy, and the Institution of Mining Engineers.

Dr. Henry M. Howe, the distinguished iron and steel metallurgist, also a past-president of the American Institute of Mining and Metallurgical Engineers, was the first chairman and is now the Honorary Chairman of the Division of Engineering. Mr. Galen H. Clevenger, long identified with nonferrous mining and metallurgy, is a vice-chairman of the division. The other vice-chairman, also, is a member of the Institute. Of this division's thirty-eight members, eighteen are members of the American Institute of Mining and Metallurgical Engineers, although a number of them officially represent other societies on the division. Many other mining engineers and metallurgists are members of committees of the National Research Council. Among the engineering societies the Institute has been prominent as an active participant in the work of the Council. During the war, many Institute members served untiringly on committees of the Council engaged upon mining and metallurgical problems for the Government and the industries. Five members of the Institute were among the founders of National Research Council: Herbert Hoover, Van H. Manning, Charles F. Rand, Charles D. Walcott and Willis R. Whitney. Dr. Walcott is President of the National Academy of Sciences, and First Vice-Chairman of the National Research Council.

Valuable as are the specific scientific and technical achievements which National Research Council already has to its credit, and the greater achievements of these kind in its future, none nor all of them can outweigh the great benefits to our country and the world growing from the better personal appreciation, the higher mutual esteem, and the effective co-operation which National Research Council is helping to bring about among scientists, technologists and industrialists. National Research Council exists to serve. Through service it expects "to have and to hold" the steady, sympathetic backing of mining and metallurgical men.

MINING AND MARKETS REVIEWED BY LABOR DEPARTMENT

REPORTS received by the Labor Department from its representatives throughout the country on the unemployment situation shed some light upon mid-September conditions in the mining, iron and steel and allied industries. The east-south-central district reported no improvement in coal mining. In Tennessee and southeastern Kentucky, during July, out of a total of 300 mines each employing from 25 to 100 men, 132 were not operated. This is more than a third of the total in the district and represents large normal production. Such mines as were operated were not running more than two or three days per week, excepting those loading fuel for the railroads. The demand was far short of normal. In western Kentucky many mines were still idle; those that were working were operating only two days per week. In Alabama there were partly employed approximately 80 percent of the number reported at the beginning of the year.

The South Atlantic district reported 22 coal mine operators in Virginia as employing 6,349 men, a decrease of 126 from previous figures. Operators generally were discouraged as to the outlook, while some confident that conditions would improve in the near future.

Unemployment continued in iron and steel. The reopening of mines in the east-north-central district for the fall trade was helping business and creating a tone of optimism. Signs of improvement in the steel industry were also evident in the middle-Atlantic district.

Mining in general in the Rocky Mountain district continued much restricted, with the exception of coal mines, which were beginning to pick up.

BRITISH STEEL MAKERS APPEAR BEFORE SENATE COMMITTEE

PRECEDENTS WERE DESTROYED when four representatives of the English high-speed steel manufacturing industry were present at a session of the Senate Finance Committee, urging that body to make changes in the Fordney Bill in order that their industry might be saved from "prohibitive duties." The delegation was headed by Arthur Balfour and was officially present as a representation from the Sheffield Chamber of Commerce, being the first group of foreign manufacturers to ever appear before a Congressional committee considering the tariff.

Mr. Balfour's statement centered in a depiction of what the proposed duties would do to the English high-speed steel industry. He cited the economic conditions existing in England at present as an argument against the handicapping of his industry through the high duties proposed. Senator Smoot directed his attention to the fact that this country faces similar problems. The witness stated that his interest would be pleased with nothing better than a continuance of the present tariff rate, but saw that this was impossible.

Mr Balfour asked the committee that the ad valorem on high-speed steel valued at 40 cents or more per lb. be reduced from the present proposal of 20 percent to 10 percent and that the compensatory duty on tungsten steel be reduced from 72 to 35 cents per lb. General opinion around the committee room was to the effect that the British interests had not greatly strengthened their position through appearing before the committee.

	Antimony.	Arsenic.	Asbestos.	Barytes.	Bismuth.
Present tariff classification:					
Schedule	Prepared, C; ore, free list.	Free list	Manufactured, N; unmanufactured, free list.	A	Free list
Paragraph	Prepared, 144; ore, 306.	408	Manufactured, 367; unmanufactured, 406.	51	419
Rate	Prepared, 25 per cent ad valorem; ore, free.	Free	Manufactured, 20 per cent ad valorem; unmanufactured, free.	15 per cent and 20 per cent ad valorem.	Free
Unit of measure	Short tons	Short tons	Short tons	Short tons	Pounds
Imports from foreign countries:					
Prewar	7,528 (1914)	1,564 (1914)		24,243 (1914)	133,100 (1914)
War time	15,233 (1918)	1,847 (1918)	134,108 (1917)	None	75,611 (1918)
Present (latest available data).	10,143 (1920)	4,000 (1920)	135,861 (1919)	10,000 (estimated), (1920).	72,771 (1920)
Imported from	China, Mexico	Canada, Mexico	Canada, South Africa, England (manufactured).	Germany	England, S America (Bol
Labor cost per diem respectively in those countries.	China, $0.45; Mexico, $1.10.	Canada, $2.50; Mexico, $1.10.	Canada, $2.50; Africa, $0.50.	Germany, $0.78	England, $2; B $1.25.
Relative trade balance of those countries with the United States.	China, creditor; Mexico, debtor.	Canada, debtor; Mexico, debtor.	Canada, debtor	Germany, debtor	England, debto livia, creditor.
Present exchange rates of those countries with the United States.	China, 1 tael=71 cents; Mexico, 1 peso=51 cents.	Canada, $1=89 cents; Mexico, 1 peso=51 cents.	Canada, $1=89 cents.	Germany, 1 mark=1½ cents.	England, £1= Bolivia, 1 boliv 33 cents.
Nature and extent of ore deposits:					
Foreign	China, large and cheaply mined; Mexican, antimonial lead an important source.	Canada, by-product from cobalt ores; Mexico, smelter by-product.	Canada, large low-grade deposits extensively developed; South Africa, both high and low grade deposits not so well developed.	German deposits large.	England refine tralian and manian ores Bolivia refine ores.
United States	Large resources; antimonial lead stibnite deposits not developed.	Large resources unassociated with other minerals and also as a by-product.	Large but undeveloped; need large capital investment.	Large deposits, both developed and undeveloped in South and Middle West.	Recovered a product of sm in quantities for domestic when market fies.
Cost of production:					
Foreign	4½ cents per pound	6 cents per pound	25 cents per pound	$1.50-$3.75	$0.75-$1.10 per p
United States	14 cents per pound	11 cents per pound	37 cents per pound	$7.97	$1.75-$2.14 per p
Prevailing prices:					
Prewar	7 cents per pound	14 cents	$300 per ton (1914)	$3.37 f. o. b. mine	$2.05 per pound
War time	21 cents per pound	12 cents	$1,800 per ton (1917)	$8.02 f. o. b. mine	$3.50 per pound
Present (latest available data).	6½ cents per pound	10 cents	$2,000 per ton (1920)	$10-$11.25 f. o. b. mine.	$1.35 per pound
Annual production in United States:					
Prewar	2,705 (short tons)	4,670 (1914)	1,479 (1914)	52,747 (1914)	213,551 (1913)
War time	24,377	6,323 (1918)	1,683 (1918)	155,368 (1918)	318,187 (1917)
Present (latest available data).	3,963 (estimated)	11,231 (1920)	1,500 (1920)	180,000 (1920)	200,834 (1920)
States in which produced.	Colorado, Arizona, New Mexico, California, Utah, Alaska, Idaho.	Nevada, Washington, Montana, Utah, Colorado, California,	Vermont, Arizona, New Mexico, California, Georgia, Maryland, Oregon.	Missouri, Georgia, Tennessee, Illinois, Maryland, Virginia, North and South Carolina (18 other States, making 26 in all).	Colorado, Utah fornia, Idaho souri, Kansas
Number of people dependent on this industry for support.	1,100	1,500	100,000 (including manufactured).	22,000	Included in emp of smelting tries.
Approximate investment.	$10,000,000	$5,000,000	$25,000,000	$15,000,000	Included in ments in sm industries.
Present condition in this industry and particular problem it is facing.	Low Chinese and Mexican labor costs.	Operating but not extending, due to lower foreign costs, jeopardizing investment.	Protection of manufacturer necessary to develop ore deposits for this market; no tariff asked on raw asbestos.	Operating but not extending. Investment jeopardized by low German costs and unfair German competition.	This valuable contained in plex ores sho protected so covery is eco cally possible.
Probable relative percentage of mineral that will be consumed under correct tariff:					
Foreign	40 per cent	25 per cent	Raw, 95 per cent; manufactured, 25 per cent.	20 per cent	25 per cent
United States	60 per cent	75 per cent	Raw, 5 per cent; manufactured, 75 per cent.	80 per cent	75 per cent
Tariff requested to protect industry.	10 cents per pound upon antimony salts and sulphuret; 10 cents per pound on antimony as regulus or metal or matte containing antimony or in antimonial lead; 8 cents per pound antimony content in antimonial ores.	5 cents per pound of As_2O_3 (white arsenic).	Paper: 5 cents per pound paper, millboard, and articles manufactured therefrom; 10 cents per pound paper and millboard manufactured from long-fiber asbestos and electrical papers not exceeding 0.0005 inch in thickness. Sheets: 1½ cents per square foot asbestos in plates with hydraulic cement not over ¼ inch in thickness; 2½ cents per square foot over ¼ inch but not over ½ inch; 5 cents per square foot over ½ inch but not over ¾ inch; 6 cents per square foot corrugated or otherwise not flat; 50 per cent ad valorem in addition; all other progressive rates named in Watson bill (H. R. 15480).	¼ cent per pound barytes crude; 1½ cents per pound barytes ground; 1½ cents per pound barium sulphide; 2 cents per pound barium carbonate; 2 cents per pound barium binoxide; 2 cents per pound barium sulphate; 2½ cents per pound barium chloride; 2½ cents per pound barium lithopone; 5 cents per pound barium nitrate; 8 cents per pound barium peroxide; all other barium compounds, 25 per cent ad valorem.	25 cents per pou
Tariff proposed in H. R. 7456:					
Schedule	3	1	14	1	Free list
Paragraph	376	1	1401	64	1523
Rate of duty	1½ cents per pound on antimony as regulus or metal.	25 per cent ad valorem on arsenic acid, arsenious acid or white arsenic.	Paper, millboard made of long fiber, electrical papers, not exceeding 0.05 inch in thickness, 8 cents per pound; made of other fibers, 1½ cents per pound; sheets and plates, 1-3½ cents per square foot wick and rope, 18-56 cents per pound; yarn, 32 cents-$1.65 per pound; textile fabrics, 42 cents-$1.40 per pound; all other manufactures, 20 per cent ad valorem.	$4 per ton on crude barytes ore; $7.50 per ton ground or manufactured; 1 cent per pound precipitated barium sulphate.	Free

Bismuth.	Cadmium.	Chromite.	Feldspar.	Fluorspar.	Graphite.	Gypsum.	Kaolin (white china clay).	Lead.	Lime.	Manganese.	
Free list	Free list	Free list	Not listed	Not listed	Free list	B	B	C	B	Free list	B
418	439	102			579	74	76	152 and 153	73	540	71
Free	Free	Free	Free	Free	Free	20 cents per ton	$1.25 per ton	Ore, three-fourths cent pound; metal, 25 per cent advalorem.	5 per cent ad valorem	Free	10
Pounds	Pounds	Long tons	Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Sh
133,190 (1914)	1,583 (1914)	90,736	15,000 (1914)	32,632 (1913)	21,600 (1914)	369,214 (1914)	338,038 (1914)	11,482 (average) (1910-15).	3,455 (1914)	283,394	13
75,611 (1918)	None (1918)	100,142	19,488 (1916)	13,616 (1917)	19,498 (1918)	240,269 (1917)	241,020 (1917)	7,781 (average) (1916-18).	7,368 (1917)	491,303	24
72,771 (1920)	No data (1920)	61,404	20,232 (1918)	20,000 (1920)	23,800 (1920)	300,000 (estimated) (1920).	180,592 (1919)	158,802, present yearly rate September-December, 1920.	6,639 (1918)	333,344	15
England, South America (Bolivia).	Germany, England	New Caledonia, Rhodesia, Canada, Costa Rica, Cuba.	Canada	England, Canada	Ceylon, Austria, Madagascar.	Canada	England	Mexico, Spain, Australia, Germany, Canada, South America.	Canada	India, Russia, Brazil, Cuba.	A
England, $2; Bolivia, $1.25.	Germany, $0.78; England, $2.	New Caledonia, convict labor; Rhodesia, $0.75; Canada, $2.50; Costa Rica, $1.25; Cuba, $2.	Canada, $2.50	England, $2; Canada, $2.50.	Ceylon, $0.24; Austria, $0.42; Madagascar, $0.32.	Canada, $2.50.	England, $2	Mexico, $1.10; Spain, $0.98; Germany, $0.78; Canada, $2.50; South America (average) $1.25.	Canada, $2.50	India, $0.24; Brazil, $1; Cuba, $1.25.	A
England, debtor; Bolivia, creditor.	Germany, debtor; England, debtor.	New Caledonia, creditor; Rhodesia, creditor; Canada, debtor, Costa Rica, creditor, Cuba, creditor.	Canada, debtor	England, debtor; Canada, debtor.	Ceylon, creditor; Austria, debtor; Madagascar, creditor.	Canada, debtor	England, debtor	Mexico, debtor; Spain, debtor; Germany, debtor; Canada, debtor; South America, creditor.	Canada, debtor	India, creditor; Russia, debtor; Brazil, creditor; Cuba, creditor.	Au
England, £1=$3.33; Bolivia, 1 boliviano=33 cents.	Germany, 1 mark=1¼ cents; England, £1=$3.33.	New Caledonia, 1 franc=7 cents; Rhodesia, £1=$3.33; Canada, $1=99 cents.	Canada, $1=99 cents.	England, £1=$3.33; Canada, $1=99 cents.	Ceylon, £1=$3.33; Austria, 1 krone=¼ cent; Madagascar, 1 franc=74 cents.	Canada, $1=99 cents.	England, £1=$3.33	Mexico, 1 peso=51 cents; Spain, 1 peseta=14 cents; Germany, 1 mark=1 cent; Canada, $1=99 cents; Australia, £1=$3.33.	Canada, $1=99 cents.	India, £1=$3.33; Brazil, 1 milreis=14 cents; Cuba, 1 peso=$1.	Au
England refines Australian and Tasmanian ores cheaply; Bolivia refines own ores.	Prior to 1907 Germany sole producer; England produces less than Germany.	Rhodesia and Caledonia extensive; Canada, scattered.	Extensive deposits; common mineral.	Large tonnage comes in as ballast.	Many years of development of large deposits gives them great advantage.	Old well-established deposits well developed.	Old established development; high-grade material.	Old well-established industry.	Common mineral widely distributed.	Old established, well-developed deposits.	La
Recovered as by-product of smelting, in quantities ample for domestic needs when market justifies.	By-product; recovery newly undertaken since 1916; quantity recoverable sufficient for needs.	Extensive, but undeveloped.	Large, valuable deposits; should be more largely developed.	Large tonnage, good grade, widely distributed; superior to foreign.	Large reserves of all grades; development primitive; needs stabilized market.	Resources vast; development progressing rapidly.	Immense reserves high-grade material; development growing rapidly.	Mammoth deposits, well developed.	Common mineral, widely distributed.	Immense reserves; development just begun; increased 3,000 per cent during the war.	La
$0.75-$1.10 per pound	75 cents per pound	$5.50 per ton	$3.25	$7	6 cents per pound	$1	$10	4 cents per pound	$6.50 per ton	$12 per ton	$10
$1.75-$2.14 per pound	$1-$1.60 per pound	$35 per ton	$5.15	$13.50	10 cents per pound	$2	$16	6 cents per pound	$8 per ton	$35 per ton	$18
$2.05 per pound (1913)	80 cents per pound (1914)	$12.75	$3.46 (1915)	$6.37 (1913)	6½ cents to 8 cents per pound.	$1.75	$5.88 (1914)	$4.37 (average 1910-1915).	$3.92 (1914)	$10.39	$15
$3.50 per pound (1918)	$1.48 per pound (1918)	$47.59	$3.40 (1917)	$10.45 (1917)	10 cents to 17½ cents per pound.	$2.74	$5.46 (1917)	$7.60 (average 1916-1918).	$6.29 (1917)	$35	$49
$1.35 per pound (1921)	$0.75-$1 per pound (1921).	$22.50-$42.50	$8.50 (1918)	$25 (1920)	4 cents per pound (Madagascar flake).	$2.15	$10.88 (1919)	4 cents (present Feb. 25, 1921).	$8.36 (1918)	$13 (present)	$30-
213,554 (1913)	54,198 (1913)	591 long tons		115,580 short tons (1913)	5,000 tons	2,476,465 (1914)	34,191 (1914)	457,500 (average, 1910-1915).	3,380,928 (1914)	2,635	11,2
318,187 (1917)	207,409 (1917)	82,430	126,715 long tons	218,828 short tons (1917)	13,503 (1916)	2,696,226 (1917)	31,885 (1917)	557,300 (average, 1916-1918).	3,736,364 (1917)	305,980	231,
269,834 (1920)	129,283 (1920)	3,900	88,439 long tons	286,000 short tons (1920)	167,879 (1917)	2,340,000 (1919)	39,000 (1919)	430,000 (yearly rate)	3,206,016 (1918)	58,243 (1919)	164,
Colorado, Utah, California, Idaho, Missouri, Kansas.	Colorado, Utah, California, Ohio, Illinois, Delaware.	California, Colorado, Oregon, Wyoming, Pennsylvania, Maryland, Alaska.	New York, Vermont, Georgia, Maine, North Carolina, California, Virginia, Pennsylvania, Connecticut, Maryland, New Jersey, New Hampshire.	Illinois, Tennessee, Kentucky, New Mexico, Colorado, Arizona, New Hampshire, Nevada, Utah, Washington.	Montana, Pennsylvania, Alabama, New York, Colorado, Texas, Georgia.	New York, Alaska, Iowa, California, Michigan, Nevada, Illinois, Oklahoma, Minnesota, Utah, Washington, Ohio, Wisconsin, New Mexico.	Georgia, California, Delaware, Texas, Missouri, Florida, North Carolina, South Carolina, Pennsylvania, Utah.	Missouri, Washington, Idaho, Oklahoma, Utah, Kansas, Colorado, Arkansas, Tennessee, Wisconsin, Montana, Illinois, California, Arizona, New Mexico.	Washington, Arizona, Pennsylvania, Kansas, Ohio, New Mexico, Colorado, West Virginia, Tennessee, Michigan, Montana, Massachusetts, California, and other.	Arkansas, Virginia, Montana, West Virginia, Colorado, Georgia, Minnesota, Tennessee, Nevada, California, New Mexico, Arizona, Vermont, Oregon, Utah, Texas.	Wa fo
Included in employees of smelting industries.	Included in employees of smelting industries.	2,500	7,500	8,500	4,500	8,000	10,000	300,000	16,000	7,500	3,00
Included in investments in smelting industries.	Included in investments in smelting industries.	$4,500,000	$5,000,000	$16,000,000	$7,500,000	$17,000,000	$12,000,000	$400,000,000	$30,000,000	$15,000,000	$13,0
This valuable metal contained in complex ores should be protected so its recovery is economically possible.	Cadmium recovery an intricate metallurgical process developed during war which should be fostered and continued.	Completely collapsed	Large development, but primitive operations, due to instability of market.	Large development, but could be greatly increased if protected.	Only 2 mines in the United States in operation and each of these on part time.	Operations expanded greatly during the war; need protection to continue.	Business had large development recent years; protection will give opportunity to use better refining methods and develop industry.	40-50 per cent of properties closed down; practically all operations solely to keep organization together in hope of relief; low foreign wage and ocean freight.	Canadian competition offers special problem to border States industry to be corrected by tariff.	Operating about 5 per cent of capacity; possibilities under protection enormous.	Com du pe
25 per cent	20 per cent	60 per cent	20 per cent	10 per cent	45 per cent	10 per cent	50 per cent	20 per cent	One-fourth of 1 per cent	55 per cent	20 pe
75 per cent	80 per cent	40 per cent	80 per cent	90 per cent	55 per cent	90 per cent	50 per cent	80 per cent	99½ per cent	45 per cent	80 pe
25 cents per pound	25 cents per pound	Ore, 60 cents per unit CR^2O^3; refractories, 65 cents per unit CR^2O^3; ferrochrome, 1¼ cents per pound chromite content; salts, 90 cents per unit chromite.	$2 per ton crude; $6 per ton ground or manufactured.	$6 per ton on grade of 80 per cent $CA F^2$ or better.	Ore under 50 per cent graphite content, 1 cent per pound; ore over 50 per cent graphite content, 2 cents per pound; lump and chip, 3 cents per pound; flake graphitic content, 6 cents per pound; manufactured graphite products graphitic content 5 cents per pound and 20 per cent ad valorem.	Crude gypsum 50 cents per ton; compensatory duties on advanced stages of manufactures.	$5 per ton	2 cents per pound on lead in ores, copper matte, etc.; 2½ cents per pound, dross bullion, pigs, bars, etc.; 2½ cents per pound, sheets, pipe, shot, glaziers, wire, etc.; 3 cents per pound, white lead pigments, etc.	Quicklime, bulk, 30 cents per 100 pounds; 50 cents per 100 pounds on quicklime in cooperage; hydrated, 40 cents per 100 pounds; pulverized, $1 per ton bulk; $1.50 sacked.	Ores, 40 cents per unit of manganese content; ferro, $1 per unit of manganese content.	Ore, cal po per
Free list	Free list	Free list	2	2	2	2	2	3	2	3	1
1523	1539	1544	207	207	211	205	207	388	204	302	47
Free	Free	Free	$1 per ton; clays or earths not specially provided for.	$5 per ton; *Provided*, That 1 year after the passage of this act duty on fluorspar shall be $4 per ton.	10 per cent ad valorem.	Crude, 25 cents per ton; ground or calcined, $1.40 per ton; white Portland cement, 8 cents per hundredweight; Keen's cement, $3.50-$14 per ton.	$2.50 per ton	Lead in ores and mattes, 1½ cents per pound; bullion, pigs, bars, scrap, etc., 2½ cents per pound; sheets, pipe, shot, wire, etc., 2¾ cents per pound.	Limestone, 5 cents per hundredweight; lime, 10 cents per hundredweight; hydrated lime, 12 cents per hundredweight.	1 cent per pound on metallic manganese contained in ore; 2½ cents per pound on manganese contained in ferromanganese.	Cruc cen de gra

Fluorspar.	Graphite.	Gypsum.	Kaolin (white china clay).	Lead.	Lime.	Manganese.	Magnesite.	Marble.	Mica.	
Not listed	Free list	B	B	C	B	Free list	B and free list	B	D	C.
	579	74	76	152 and 153	73	540	71 and 539	97 and 98	77	102
Free	Free	30 cents per ton	$1.25 per ton	Ore, three-fourths cent pound; metal, 25 per cent advalorem.	5 per cent ad valorem	Free	10 per cent ad valorem and free.	50 cents per cubic foot	4 cents per pound and 25 per cent ad valorem.	20
Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Short tons	Blocks, cubic foot; slabs, linear foot.	Sheet pounds; scrap and ground, tons.	Po
22,682 (1913)	21,000 (1914)	369,214 (1914)	328,038 (1914)	11,452 (average) (1910-15).	3,455 (1914)	283,294	135,170	643,446-275,888 (1913)	380,380-404,843 pounds.	
13,616 (1917)	19,498 (1918)	240,269 (1917)	241,029 (1917)	7,781 (average) (1916-18).	7,353 (1917)	491,303	94,481	207,250-124,935 (1917)	741,429-11,587 pounds.	178
20,000 (1920)	32,500 (1920)	300,000 (estimated) (1920).	180,592 (1919)	158,802, present yearly rate September-December, 1920.	6,656 (1918)	333,344	15,853	479,691 (1920)	1,375,927-62 pounds.	100
England, Canada	Ceylon, Austria, Madagascar.	Canada	England	Mexico, Spain, Australia, Germany, Canada, South America.	Canada	India, Russia, Brazil, Cuba.	Austria, Canada, Greece, Mexico, Venezuela.	Italy, France, Mexico, Belgium.	India, Canada, Germany, Brazil.	Ca
England, $2; Canada, $2.50.	Ceylon, $0.24; Austria, $0.42; Madagascar, $0.33.	Canada, $2.50	England, $2	Mexico, $1.10; Spain, $0.98; Germany, $0.78; Canada, $2.50; South America (average) $1.25.	Canada, $2.50	India, $0.34; Brazil, $1; Cuba, $1.25.	Austria, $0.62; Canada, $2.50; Greece, $1.85; Mexico, $1.10; Venezuela, $1.25.	Italy, $1.70; France, $1.12; Mexico, $1.10; Belgium, $1.80.	India, $0.34; Canada, $2.50; Germany, $0.78; Brazil, $1.25.	Ca
England, debtor; Canada, debtor.	Ceylon, creditor; Austria, debtor; Madagascar, creditor.	Canada, debtor	England, debtor	Mexico, debtor; Spain, debtor; Germany, debtor; Canada, debtor; South America, creditor.	Canada, debtor	India, creditor; Russia, debtor; Brazil, creditor; Cuba, creditor.	Austria, debtor; Canada, debtor; Greece, debtor; Mexico, debtor; Venezuela, debtor.	Italy, debtor; France, debtor; Mexico, Belgium, debtor.	India, creditor; Canada, debtor; Germany, debtor; Brazil, creditor.	Ca
England, £1=$3.83; Canada, $1=89 cents.	Ceylon, £1=$3.83; Austria, 1 krone=¼ cent; Madagascar, 1 franc=74 cents.	Canada, $1=89 cents.	England, £1=$3.83	Mexico, 1 peso=51 cents; Spain, 1 peseta=14 cents; Germany, 1 mark=1 cent; Canada, $1=89 cents; Australia, £1=$3.83.	Canada, $1=89 cents.	India, £1=$3.83; Brazil, 1 milreis=14 cents; Cuba, 1 peso=$1.	Austria, 1 krone=¼ cent; Canada, $1=89 cents; Greece, 1 drachma=12 cents; Mexico, 1 peso=51 cents.	Italy, 1 lira=4 cents; France, 1 franc=7 cents; Mexico, 1 peso=51 cents; Belgium, 1 franc=7 cents.	India, £1=$3.83; Canada, $1=89 cents; Germany, 1 mark=1 cent; Brazil, 1 milreis=14 cents.	Ca
Large tonnage comes in as ballast.	Many years of development of large deposits gives them great advantage.	Old well-established deposits well developed.	Old established development; high-grade material.	Old well-established industry.	Common mineral widely distributed.	Old established, well-developed deposits.	Large deposits in Austria; principal source of imports.	Italy main source of imports; deposits large and well developed.	Industry old and well developed; deposits large; low-paid labor in India.	
Large tonnage, good grade, widely distributed; superior to foreign.	Large reserves of all grades; development primitive; needs stabilized market.	Resources vast; development progressing rapidly.	Immense reserves high-grade material; development growing rapidly.	Mammoth deposits, well developed.	Common mineral, widely distributed.	Immense reserves; development just begun; increased 3,000 per cent during the war.	Large high-grade deposits in California and Washington; immense resources.	Deposits large and high grade; can successfully compete with Italian if protected.	Large both high and medium grades; development primitive; with protection can be made great industry.	La
$7	6 cents per pound	$1	$10	4 cents per pound	$6.50 per ton	$12 per ton	$10-$12.50 per ton	$1.50 per cubic foot	Sheet, 15 cents per pound; scrap, $25 per ton.	50
$13.50	10 cents per pound	$2	$16	6 cents per pound	$8 per ton	$35 per ton	$18-$24 per ton	$2.83 per cubic foot	Sheet, 40 cents per pound; scrap, $100 per ton.	95
$6.37 (1913)	6½ cents to 8 cents per pound.	$1.75	$5.88 (1914)	$4.37 (average 1910-1915).	$3.92 (1914)	$10.39	$15.20-$15.72	$2.20 per cubic foot	Sheet, 25 cents per pound; scrap, $82 per ton.	
$10.45 (1917)	10 cents to 17½ cents per pound.	$2.74	$5.46 (1917)	$7.60 (average 1916-1918).	$6.29 (1917)	$35	$49.10	$3.85 per cubic foot	Sheet, 60 cents per pound; scrap, $122 per ton.	$1
$25 (1920)	4 cents per pound (Madagascar flake).	$2.15	$10.88 (1919)	4 cents (present Feb. 25, 1921).	$8.36 (1918)	$18 (present)	$30-35 (crude), $50-$60 (talc).	$3 per cubic foot	Sheet, 40 cents per pound; scrap, $60 per ton.	$0
115,580 short tons (1913)	5,000 tons	2,476,465 (1914)	34,191 (1914)	457,500 (average, 1910-1915).	3,380,928 (1914)	2,635	11,293	3,461,997 cubic feet (1914).	556,933 pounds, 3,730 short tons.	1,
218,828 short tons (1917)	13,503 (1916)	2,696,226 (1917)	31,885 (1917)	567,300 (average, 1916-1918).	3,786,364 (1917)	305,869	231,605	3,575,670 cubic feet (1918).	1,644,200 pounds, 2,292 short tons.	80
286,000 short tons (1920)	167,879 (1917)	2,340,000 (1919)	39,000 (1919)	430,000 (yearly rate)	3,206,016 (1918)	58,243 (1919)	164,696	4,678,000 cubic feet (1920).	1,500,000 pounds, 1,800 short tons.	
Illinois, Tennessee, Kentucky, New Mexico, Colorado, Arizona, New Hampshire, Nevada, Utah, Washington.	Montana, Pennsylvania, Alabama, New York, Colorado, Texas, Georgia.	New York, Alaska, Iowa, California, Michigan, Nevada, Illinois, Oklahoma, Minnesota, Utah, Washington, Ohio, Wisconsin, New Mexico.	Georgia, California, Delaware, Texas, Missouri, Florida, North Carolina, South Carolina, Pennsylvania, Utah.	Missouri, Washington, Idaho, Oklahoma, Utah, Kansas, Colorado, Arkansas, Tennessee, Wisconsin, Montana, Illinois, California, Arizona, New Mexico.	Washington, Arizona, Pennsylvania, Kansas, Ohio, New Mexico, Colorado, West Virginia, Tennessee, Michigan, Montana, Massachusetts, California, and other.	Arkansas, Virginia, Montana, West Virginia, Colorado, Georgia, Minnesota, Tennessee, Nevada, California, New Mexico, Arizona, Vermont, Oregon, Utah, Texas.	Washington, California.	Alabama, Pennsylvania, Virginia, Alaska, Massachusetts, New Mexico, Arizona, Missouri, Oregon, Arkansas, New York, Michigan, California, North Carolina, Washington, Colorado, Tennessee, Georgia, Texas Maryland, Vermont.	North Carolina, Virginia, South Carolina, Idaho, Georgia, New Mexico, Colorado, South Dakota, Alabama, New Hampshire.	T
8,500	4,509	8,000	10,000	300,000	16,000	7,500	3,000	15,000	5,000	1,
$16,000,000	$7,500,000	$17,000,000	$12,000,000	$400,000,000	$30,000,000	$15,000,000	$13,000,000	$32,000,000	$5,000,000	$
Large development, but could be greatly increased if protected.	Only 2 mines in the United States in operation and each of these on part time.	Operations expanded greatly during the war; need protection to continue.	Business had large development recent years; protection will give opportunity to use better refining methods and develop industry.	40-50 per cent of properties closed down; practically all operations solely to keep organization together in hope of relief; low foreign wage and ocean freight.	Canadian competition offers special problem to border States industry to be corrected by tariff.	Operating about 5 per cent of capacity; possibilities under protection enormous.	Completely shut down due to foreign competition.	Operating but needs protection to justify increased investment by assured continuous operation.	Sustained production; growing despite handicap of foreign competition; protection imperative to interest investment.	V
10 per cent	45 per cent	10 per cent	50 per cent	20 per cent	One-fourth of 1 per cent	55 per cent	20 per cent	15 per cent	35 per cent	2
90 per cent	55 per cent	90 per cent	50 per cent	80 per cent	99¾ per cent	45 per cent	80 per cent	85 per cent	65 per cent	8
$5 per ton on grade of 80 per cent CA F^2 or better.	Ore under 50 per cent graphite content, 1 cent per pound; ore over 50 per cent graphite content, 2 cents per pound; lump and chip, 3 cents per pound; flake graphitic content, 6 cents per pound; manufactured graphite products graphitic content 5 cents per pound and 20 per cent ad valorem.	Crude gypsum 50 cents per ton; compensatory duties on advanced stages of manufactures.	$5 per ton	2 cents per pound on lead in ores, copper matte, etc.; 2¼ cents per pound, dross bullion, pigs, bars, etc.; 2½ cents per pound, sheets, pipe, shot, glaziers, wire, etc.; 3 cents per pound, white lead pigments, etc.	Quicklime, bulk, 30 cents per 100 pounds; 50 cents per 100 pounds on quicklime in cooperage; hydrated, 40 cents per 100 pounds; pulverized, $1 per ton bulk; $1.50 sacked.	Ores, 40 cents per unit of manganese content; ferro, $1 per unit of manganese content.	Ore, ½ cent per pound; calcined, ¾ cent per pound; brick, ¾ cent per pound.	Marble, onyx, and breccias and limestones susceptible of polish in blocks, $1 per cubic foot; slabs less than 1 inch in thickness, 8 cents per linear foot; over 1 inch, 10 cents per linear foot; over 1½ inches, 12½ cents per linear foot; over 2 inches, $1 per cubic foot. 2 cents per foot additional if rubbed; finished marble, 75 per cent ad valorem.	Mica unfinished and rough, valued at not over 30 cents per pound, 10 cents per pound plus 30 per cent advalorem; above 30 cents per pound, 30 per cent ad valorem; cut, stamped, and punched, 20 cents per pound plus 60 per cent ad valorem; splittings 30 per cent ad valorem; built up mica and all manufactures of mica, 60 per cent ad valorem; diaphragms, 10 cents plus 60 per cent ad valorem; crude, raw, scrap, refuse, fit only for grinding, 2 cents per pound; ground, flake and dust, 4 cents per pound.	
2 207 $5 per ton; *Provided*, That 1 year after the passage of this act duty on fluorspar shall be $4 per ton.	2 211 10 per cent ad valorem.	2 205 Crude, 25 cents per ton; ground or calcined, $1.40 per ton; white Portland cement, 8 cents per hundredweight; Keen's cement, $3.50-$14 per ton.	2 207 $2.50 per ton	3 388 Lead in ores and mattes, 1½ cents per pound; bullion, pigs, bars, scrap, etc., 2½ cents per pound; sheets, pipe, shot, wire, etc., 2¾ cents per pound.	2 204 Limestone, 5 cents per hundredweight; lime, 10 cents per hundredweight; hydrated lime, 12 cents per hundredweight.	3 302 1 cent per pound on metallic manganese contained in ore; 2½ cents per pound on manganese contained in ferromanganese.	1 47 Crude or ground; ¾ cent per pound; dead-burned or grained.	2 233 40 per cent ad valorem.	2 208 Unmanufactured or rough trimmed, 4 cents per pound and 17 per cent ad valorem; cut, trimmed, and manufactured, 10 cents per pound and 17 per cent ad valorem; ground, 4 cents per pound and 20 per cent ad valorem.	

...ica.	Molybdenum.	Monazite and thorium.	Pyrites.	Pumice.	Potash.	Quicksilver.	Talc.	Tungsten.	Zinc.
.....	C.....	C.....	Free list.....	B.....	Free list.....	C.....	A.....	Ferro, C; ores, free list.	A; C.
.....	102.....	154.....	617.....	75.....	580.....	159.....	69.....	Ferro, 102; ores, 633.....	61; 162–163.
r pound and cent ad va-	30 and 25 per cent ad valorem on ferro-molybdenum.	25 per cent ad valorem.	Free.....	5 per cent ad valorem..	Free.....	10 per cent ad valorem.	15 per cent ad valorem.	20 per cent ad valorem; ores, free.	10–15 per cent; 10 and 15 per cent.
unds; scrap und, tons.	Pounds.....	Pounds.....	Long tons.....	Short tons.....	Short tons.....	75-pound flasks.....	Short tons.....	Short tons.....	Short tons.
4,845 pounds.	.....	Monazite, 1,873,971; thorium, 101,927 (1915).	1,026,617.....	Unmanufactured, 5,558 (1913).	207,089.....	8,198.....	18,882 (1916).....	1,530 (1913).....	Ore (average), 61,342; slab, 5,941.
,567 pounds..	178,222.....	Monazite, 5,823,270; thorium, 1,188 (1917).	496,792.....	Unmanufactured, 3,000 (1918).	7,957.....	6,719.....	14,169 (1918).....	11,750 (1918).....	Ore (average), 199,281; slab, 420.
62 pounds....	106,743.....	Monazite, 632,566; thorium, 5,307 (1919)	288,973.....	.....	40,629 (estimated 40,000).	16,300 (1920).....	34,000 (1920).....	4,220 (1920).....	Ore (average), 53,510; slab, 2,590.
anada, Ger- Brazil.	Canada, Australia, Norway, Japan, Peru.	Brazil, India.....	Spain, Canada, Portugal.	Italy.....	Germany, France.....	Spain, Italy, Austria..	Canada, Italy, France, England (as merchant for provinces).	China, Burma, Bolivia.	Mexico, Belgium, Germany, Australia.
.24; Canada, Germany, Brazil, $1.25.	Canada, $3.50; Australia, $3; Norway, $1; Japan, $0.67; Peru $1.25.	Brazil, $1.25; India, $0.24.	Spain, $0.75; Canada, $3; Portugal, $0.85.	Italy, $1.76.....	Germany, $0.78; France, $1.12.	Spain, $0.78; Italy, $1.76; Austria, $0.62.	Canada, $1; Italy $1.76; France, $1.12; England, $0.75 (average).	China $0.45; Burma, $0.40; Bolivia, $0.90.	Mexico, $1.16; Belgium, $1.44; Germany, $0.73; Australia, $3.
editor; Can- debtor; Ger- debtor; Bra- litor.	Canada, debtor; Australia, debtor; Norway, debtor; Japan, creditor; Peru, creditor.	Brazil, creditor; India, creditor.	Spain, debtor; Canada, debtor; Portugal, debtor.	Italy, debtor.....	Germany, debtor; France, debtor.	Spain, debtor; Italy, debtor; Austria, debtor.	Canada, debtor; Italy, debtor; France, debtor; England, debtor.	China, creditor; Burma, creditor; Bolivia, creditor.	Mexico, debtor; Belgium, debtor; Germany, debtor; Australia, debtor.
—$2.83; Can- l=89 cents; ny, 1 mark= Brazil, 1 mil- cents.	Canada, $1=89 cents; Australia, £1=$3.83; Norway, 1 krone=18 cents; Japan, 1 yen=40 cents; Peru, 1 libra=$4.73.	Brazil, 1 milreis=14 cents; India, 1 rupee =28½ cents.	Spain, 1 peseta=14 cents; Canada, $1=99 cents; Portugal, 1 escudo=21 cents.	Italy, 1 lira=4 cents...	Germany, 1 mark=1 cent; France, 1 franc=7 cents.	Spain, 1 peseta=14 cents; Italy, 1 lira=4 cents; Austria, 1 krone=¼ cent.	Canada, $1=99 cents; Italy, 1 lira=4 cents; France, 1 franc=7 cents; England, £1=$3.83.	China, 1 tael=71 cents; Burma, 1 rupee=38 cents; Bolivia, 1 boliviano=43 cents.	Mexico, 1 peso=51 cents; Belgium, 1 franc=7 cents; Germany, 1 mark=24 cents; Australia, £1=$3.83.
old and well ped; deposits ow-paid labor a.	Norway deposits large; reduced by hydro-electric power.	Deposits of Brazil and India in large beds of seacost sand, so labor cost is especially low.	Spanish deposits principal competitor; mined as by-product of copper and sold regardless of mining cost.	Italian pumice a lava deposit that must be ground.	German potash has monopolized all markets for years and is now trying to regain its domination.	Spanish and Italian deposits largely Government monopolies. Imports of quicksilver into these countries are embargoed.	70 per cent from Canada, high-grade deposits cheaply mined; established industry.	Surface deposits; hand labor at a few cents per day. Before the war Germany monopolized tungsten refining.	Mexican and Australian deposits immense. Belgium and Germany refiners and export finished zinc.
th high and n grades; de- ent * prim- ith protection made great ry.	Largest and most important deposits in world in United States.	Deposits large and high grade but must be concentrated.	Large and high-grade with valuable by-products capable of immense expansion and development.	Deposits large but far from market; lower grade suitable for cleansers.	Reserves enormous enough to supply United States for generations if protected in development.	Deposits large grade of ore compels extensive refining; operations possible with protection.	Large domestic resources discovered and developed during war; able to supply our needs.	Extensive enormous growth during war freed United States from German domination.	Deposits large, rich, and adequate for all domestic purposes and for export.
5 cents per ; scrap, $25 per	80 cents per pound MoS_2.	Monazite, 6 cents per pound; thorium, $4.	Spanish cost can be estimated at naught, as they sell for cost of freight.	$13.50 per ton.....	$1 per unit K_2O.....	$30 per flask.....	$12.25 per ton (crude)..	$2.50–$10 per unit.....	5 cents per pound, zinc.
0 cents per ; scrap, $100 .	95 cents per pound MoS_2.	Monazite, 21 cents; thorium, $7.	11 cents per unit.....	$30.94 per ton, f. o. b. New York.	$1.75 per unit K_2O....	$75 per flask.....	$17.50 per ton (crude)..	$17 per unit WO_3.....	7½ cents per pound, zinc.
25 cents per ; scrap, $82 per	.....	Monazite, 12 cents per pound; thorium, $6.53 (1905).	9½ cents per unit of sulphur.	$8 (1913) at Italian ports.	$1 per unit K_2O.....	$48.35 (1913).....	$9.51 per ton (1916)....	$7.32 (1913).....	$5.08 per pound (average).
30 cents per ; scrap, $122 .	$1.45 per pound MoS_2, $4.50.	Monazite, 6½ cents per pound; thorium, $8 (1917).	25 cents–33 cents.....	.....	$6 per unit K_2O.....	$123.47 (1918).....	$10.91 per ton (1918)...	$30, and as high as $92.50.	$12.22 per pound (average).
40 cents per ; scrap, $60 .	$0.75 per pound MoS_2, $2.25.	Monazite, 7½ cents per pound; thorium, $3.75 (1919).	12 cents–16 cents.....	$13.50 (1920) at Italian ports.	$2 per unit K_2O.....	$40 (1920).....	$20 per ton (1920).....	$2.75 (1921).....	$5.20 per pound (average).
pounds, 3,730 ons.	1,297 pounds MoS_2....	1,344,418 (1905).....	336,662 long tons.....	27,591 tons (1914).....	.....	16,548 flasks.....	193,309 tons (1916).....	1,537 (1913).....	332,916.
pounds, 2,292 ons.	801,637 pounds MoS_2...	22,000 (1917).....	464,491	35,283 (1917).....	54,908	32,883 flasks.....	191,477 tons (1918).....	6,144 (1917).....	668,513 (1916–17).
pounds, 1,800 ons.	.....	No recorded production 1920.	380,000.....	.....	36,890	21,348 flasks.....	213,000 tons (1920).....	None (1920).....	464,000.
Carolina, Vir- South Caro- daho, Georgia, Mexico, Colo- South Dakota, ama, New shire.	Texas, Wyoming, Maine, Colorado, New Mexico, Arizona, Alaska, California.	North Carolina, South Carolina, Idaho, Florida.	Virginia, California, Georgia, New York, North Carolina, South Carolina, Utah.	California, Colorado, Arizona, Utah, Nebraska, New Mexico, Kansas, Idaho, Oregon, Washington, Nevada.	Nebraska, Utah, New Jersey, California, Colorado.	California, Texas, Idaho, Nevada, Oregon, Arizona.	Vermont, Massachusetts, New York, California, North Carolina, Georgia, Maryland, Pennsylvania, New Jersey.	California, Idaho, Colorado, Montana, Nevada, Oregon, Arizona, New York, Washington, Alaska, South Dakota.	Missouri, Utah, Kansas, Illinois, Oklahoma, Pennsylvania, New Jersey, New Mexico, Montana, Arizona, Wisconsin, West Virginia, Colorado, Tennessee, Idaho.
.....	1,000.....	250.....	5,000.....	1,200.....	15,000.....	4,500.....	7,500.....	3,500.....	100,000.
00.....	$6,500,000.....	$50,000.....	$10,000,000.....	$5,000,000.....	$45,000,000.....	$3,500,000.....	8,575,000.....	$15,800,000.....	$300,000,000.
ed production; ng despite han- of foreign com- on; protection ative to inter- vestment.	While in expensive development stage and conducting educational campaign to increase use, needs protection from foreign low costs.	Removal of protection in 1909 and 1913 ruined this industry; can be again built up under protection.	Spanish mines will dump pyrites here for cost of freight as ballast; protection against this dumping urgent.	Domestic pumice filled part of demand during war time; development under protection dubious.	Industry developed from nothing to present size during war. Unless protected will disappear; one of the key industries.	Above Government monopolies dumping 2,000 flasks per month here. Our industry closed; continuance a military necessity.	Canadian competition most serious; when talc is dumped here domestic market is broken.	Stabilized prices by protection against wide ranges foreign prices under dumping methods now used will permit operation of this key industry.	More than 75 per cent of all operations closed down; higher American labor costs, 8-hour day, and higher freight; foreign zinc is being dumped here.
ent.....	20 per cent.....	25 per cent.....	30 per cent.....	25 per cent.....	40 per cent.....	45 per cent.....	10 per cent.....	25 per cent.....	10 per cent.
ent.....	80 per cent.....	75 per cent.....	70 per cent.....	75 per cent.....	60 per cent.....	55 per cent.....	90 per cent.....	75 per cent.....	90 per cent.
nfinished and , valued at not 30 cents per d, 10 cents per d plus 30 per ad valorem; e 30 cents per d, 30 per cent valorem; cut, n ped, and hed, 20 cents pound plus 60 ent ad valorem; tings 30 per cent alorem; built up and all manu- ures of mica, 60 ent ad valorem; hragms, 10 cents 60 per cent ad rem; crude, raw, p, refuse, fit only rinding, 2 cents pound; ground, and dust, 4 s per pound.	50 cents per pound of MoS_2 in ores and concentrates, $1 per pound of Mo contained in ferro-molybdenum, calcium molybdate and all other alloys and compounds of molybdenum including molybdenum steel.	15 cents per pound monazite sand; $3 per pound of thorium nitrate; $2 per pound on gas mantle scrap.	Cuprous, cupriferous or iron pyrites, $4 per ton.	Unmanufactured pumice stone, manufactured pumice stone, or manufactures of pumice, 1 cent per pound.	50 cents per unit K_2O..	Quicksilver, 50 cents per pound; manufactured mercurial products, 50 cents per pound of mercury content and 33⅓ per cent ad valorem.	Talc steatite soapstone and French chalk, crude and unground, ½ cent per pound; washed, powdered, or pulverized, 1 cent per pound; cut or sawed or in the form of blanks, cubes, or crayons, 2 cents per pound (the rates in the Fordney bill).	On ores, $9 per unit WO_3 contained therein; on tungsten contained in ferrotungsten, tungsten metal, tungsten powder, and tungsten compounds, 90 cents per pound of tungsten contained therein; on high-speed tungsten tool steel and all alloy steels containing tungsten, 65 per cent ad valorem.	Ores less than 10 per cent zinc, free; ores over 10 per cent and less than 25 per cent, 1½ cents per pound on zinc content; ores and zinc drosses containing more than 25 per cent metallic zinc, 2 cents per pound on zinc content; blocks, pigs, or slabs, old and worn-out zinc fit only to be remanufactured, 2½ cents per pound; zinc oxide, pigment containing zinc, not containing lead, dry, 2½ cents per pound; sheets, plates, or otherwise fabricated, zinc dust, 3½ cents per pound.
.....	3.....	Free list.....	Free list.....	2.....	Free list.....	3.....	2.....	3.....	3.
.....	302.....	1616.....	1663.....	206.....	1635.....	383.....	209.....	302.....	300.
nufactured or gh trimmed, 4 s per pound and er cent ad valo- ; cut, trimmed, manufactured, ents per pound 17 per cent ad rem; ground, 4 s per pound and er cent ad valo-	Ore or concentrates 75 cents per pound on metallic molybdenum contained therein; metallic molybdenum compounds and alloys, $1.25 per pound on metallic molybdenum contained.	Free.....	Free.....	Valued at less than $15 per ton, 0.2 cents per pound; valued above $15 per ton, 0.3 cents per pound; manufactured, 0.55 cents per pound; manufactures of pumice stone, 26 per cent ad valorem.	2½ cents per pound on contained potassium oxide for a period of 2 years; 2 cents per pound for the third year; 1½ cents per pound for the fourth year; 1 cent per pound for the fifth year; thereafter, free.	35 cents per pound....	Crude, ¼ cent per pound; ground, ½ cent per pound; cut or sawed, 1 cent per pound; manufactures not decorated, 35 per cent ad valorem; manufactures decorated, 30 per cent ad valorem.	Ore or concentrates 45 cents per pound metallic tungsten contained; ferrotungsten, metallictungsten, tungsten powder, and all other compounds, 72 cents per pound on tungsten contained, plus 15 per cent ad valorem.	Ore containing less than 10 per cent of zinc, free; 10 per cent or more and less than 20 per cent, ½ cent per pound on zinc contained, 20 per cent or more or less than 25 per cent, 1 cent per pound; 25 per cent or more, 1½ cents per pound; blocks, pigs, dust, 1¾ cents per pound; sheets, 1¾ cents per pound; sheets, coated or plated, 1¾ cents per pound; scrap, 1 cent pound: *Provided*, that 2 years after enactment of this act rates shall be: Blocks, pigs, and scrap, 2 cents per pound; sheets, plate or other forms, 3½ cents per pound.

THE RARER METALS

By Frank L. Hess.*

THE MARKET for the rarer metals is not dead, but it is very somnolent. About the only signs of life are in the radium industry. Whether times are good or bad, disease, like hunger, comes upon us and must be treated, and so radium is needed always. But business in tungsten, chromium, molybdenum, titanium, nickel, cobalt, and vanadium, all of which depend mostly on the steel trade, has been so quiescent that the industry is making scarcely a sound other than that made by the discussion of tariffs. The long period of quietude in these metals has raised a question in some minds as to whether they will ever "come back," and it seems worth while to review the situation briefly.**

FRANK L. HESS
Specialist on the Rarer Metals,
U. S. Geological Survey

Tungsten

I have said before that the use of tungsten in tool steel is as staple as that of yeast in bread. But will it still be true when business again starts to hum? When the long, hot shavings again begin to twist and squirm from the high-powered metal lathes, will they be turned off by tungsten steel? It seems safe to answer positively, "Yes." During the Great War the price of tungsten reached, in at least a few transactions, more than $10.50 per pound for tungsten powder carrying about 98 percent of tungsten, and ores sold at the mine for as much as $93.50 per unit. Tungsten high-speed steel carried from 16 to 20 percent of tungsten, which generally represented an addition of 20 to 25 percent in the melt, for losses ran from 12½ percent to more than 20 percent, and yet with such a cold cash inducement to offer substitutes they generally made but a small showing. The one exception was "stellite," Elwood Hayne's fine alloy, the composition of which varies according to the purpose it is intended to serve but which in general has a base of about 25 percent chromium and 75 percent of cobalt, to which is added as much as or even more than 12 percent of tungsten or even more when it is to take the place of tool steel —so that even in stellite tungsten is essential, though in smaller quantity.

Tungsten miners and users were somewhat dubiously interested in rumors from England that Prof. Arnold had invented a molybdenum steel that would replace tungsten steels and be better. There was the usual talk of mystery and government control, but when details were finally obtained the steel appeared to be very similar to others made in this country many years ago.

Tungsten will again be used as it was before the great slump in business. However, without regard to tariffs, it will be a considerable time before American mines can again begin producing tungsten ore profitably. Before the Great War the United States was in most years the largest producer of tungsten ores; Burma was second and surpassed us for a couple of years. In the Hermyingyi mine Burma claimed to have the largest tungsten producer, but the mine has not been even a close second to our own Atolia mine, producing less than half as much from 1910 to 1917, inclusive, as shown by the table on the next page.

As a matter of fact, both the Primos Chemical Co. and the Wolf Tongue Mining Co., in the Boulder ferberite field, Colo., produced more tungsten in the same years than the Hermyingyi. But the cheaply, easily mined ores are mostly gone from the known Burmese deposits, and whereas the operators once talked of ores that could be profitably produced at $2.25 per long-ton unit, they are now talking of $7 to $10 as the cost of production, and in the United States we find the cost generally estimated at twice as much. But as everyone concerned knows, the high prices of the Great War caused the discovery in China of the greatest and most cheaply worked tungsten field yet known. This field lies in eastern Kwangtung, southern Kiangsi, and southeastern Hunan and northern Kwangsi. So far nearly all the tungsten produced in this field except that from Hunan has apparently been derived from placers but beginning with 1918 the yearly output has been larger than the annual production of the world before the Great War. When prices were high the ore came on the market at high prices; when they dropped, the Chinese price went down, but ore has kept coming even while it is offered at $3.25 per unit for concentrate carrying 72 percent WO_3. Therein lies one difference between the Chinese and the American—the Chinese demands and if he can gets a good price and spends money freely, but if he can not get what he wants, then, unlike the American, he goes right ahead working and makes what he can, and so Chinese ore has been offered on the English market at 11s. per long-ton unit, or less $1.85 per short-ton unit, the lowest ever known.

The high prices also brought considerable quantities of tungsten ores from Bolivia, Argentina, Japan, and Korea, and the sudden signing of the armistice left large stocks on hand and in transit, other stocks ready for shipment in other countries, mines running that were loath to shut down, and both the ore already produced and that being mined largely found their way to this country even with rapidly sinking prices.

At the end of 1918, the year that saw the close of the war, there was probably stored in this country an equivalent of at least 6,000 short tons of tungsten concentrates carrying 60 percent WO_3. Great quantities of tungsten steel were remelted during the short spurt in business during 1919, and stocks, instead of dwindling, increased; they kept increasing during 1920, until now it is probable that there is the equivalent of 13,000 short tons of ore carrying 60 percent WO_3 in storage in warehouses of New

*Published by permission of the Director of the U. S. Geological Survey.
**Since this article was written, even the radium mines are reported to have been closed.

York and other places and steel at works.

The normal annual consumption of tungsten concentrates in this country is not much more than 3,000 short tons of 60 per cent concentrates, and no new uses absorbing much tungsten during peace times have been developed, so that from present knowledge it is apparently plain that little market for new concentrates can be expected, with or without a tariff of any size, for four years after the high-speed tool steel industry wakes from its present stupor, and no one knows when that will be.

A TIN PROSPECTOR'S CABIN

On Cape Mountain, Cape Prince of Wales, Alaska. The wind blows so fiercely that snow is packed against all objects in its way. Note the stake at the right

Comparison of the output of the Hermyingyi mine (Tavoy, Burma) with that of the Atolia mine (Atolia, Calif.)

Year	Hermyingyi mine (wolframite)		Atolia mine (scheelite)
	Concentrates (40% WO_3 and 30% Sn) (long tons).	Equivalent in concentrates 60% WO_3 (short tons).	Concentrates 60% WO_3
1910	0.9	1	405
1911	86.3	64	259
1912	177.8	133	395
1913	189.4	141	462
1914	432.12	323	420
1915	640.29	479	794
1916	775.41	579	1844
1917	1038.	775	1783
	3339.22	2495	6362

CHROMIUM

We are still so near to the Great War that we feel its influence in nearly all commercial enterprises, and chromium mining is no exception.

Before the Great War little thought was given to the idea of furnishing our entire supply of chromium ore from domestic deposits. The ores of New Caledonia, Rhodesia, Turkey, and Greece were too plentiful, of too high grade, and too cheap for successful competition. The use of chromium in tool steel, armorplate, stainless steel, and stellite, of chromite in refractory brick and for lining furnaces direct, and of chromates in tanning leather and in pigments had been increasing, but when the war caught us in its grip both use and price increased immensely. Shipping was at so great a premium that lower-grade ore was accepted and used at three times the price formerly paid for high-grade ore. The United States Geological Survey and the Bureau of Mines had representatives in the field helping to stimulate mining, and it went on at an increasing rate until the signing of the armistice. A large stock was left in the hands of producers, and most of it is still there. A considerable quantity was marketed in 1919, but it was probably nearly all newly mined ore.

RARE MINERALS IN THE DUNES

A lagoon behind the beach, at Pablo Beach, Florida. The dunes at the edge of high-tide level are seen in the background. In the beach are segregations of ilmenite, rutile and other heavy minerals. The dunes also carry the minerals

The high prices influenced the rich mines of other countries to produce ore quite as much as those in this country, and the foreign ore has kept on coming through our ports, for at no time have prices been below the pre-war standard under which foreign mines operated. The figures collected by Edward Sampson[1] show that these ores averaged in the foreign countries $9.56 per long ton in 1913, $8.77 in 1914, $10.20 in 1915, $13.35 in 1916, $15.41 in 1917, $28.29 in 1918, $22.50 in 1919, and $12.79 in 1920. Large users are thought to have considerable stocks on hand, and chromite has recently been a drug on the market, offerings of 50 percent ore at $20 per long ton finding no buyers.

Unlike that for tungsten, the intensive prospecting for chromite occasioned by war prices discovered a considerable number of large new deposits, probably the principal of which are those in Stillwater and Sweet Grass counties, Mont. However, like most if not all other chromite deposits, they have been formed either by differentiation or some related process from the peridotite and pyroxenite in which they are found, and although the outcrops are extensive,[2] the depth must be considered very uncertain until proved by mining or drilling. The deposits are 34 to 43 miles from a railroad, and a distance that is geographically rather short may be commercially very long. Thus in Bolivia I have seen mines where there was little difference in cost between eucalyptus timbers brought 75 miles and Oregon pine brought 6,000 miles. The Montana ores would have a long haul to market and probably can not be worked in competition with the rich ores that can be bought in New York for 50 cents per long-ton unit.

Cheap chromium may extend the uses of the metal considerably. It has been suggested that stainless steel might be used for casing in certain oil wells where the casing is badly attacked by electrolysis, and that it might be used in reinforcing seawalls and other concrete structures that are broken up by the rusting of steel.

A VANADINITE PROSPECT
At Dripping Springs, Arizona. Since this photograph was taken, hundreds of tons of ore have been mined

MOLYBDENUM

Molybdenum is, like some social aspirants, not yet quite sure of its place. It has been backed with splendid faith and good hard dollars. There are many small mines and prospects over the country, and before the Great War numberless experiments had been made to use it in steel; Dr. Mathews, of the Crucible Steel Co., patented molybdenum steels in 1905.[3] The showiness of molybdenite in white quartz, the comparative ease of its metallurgy, and the marvelous things that have been accomplished with tungsten, vanadium, chromium, and manganese have made it an attractive subject of research. About the time the United States entered the war the Climax Molybdenum Co. and the Molybdenum Products Corporation started exploitation of a great deposit of which each owned a part, though the holdings of the former were much the larger. The Climax Molybdenum Co. spent a million dollars and erected a mill with a capacity of 1,000 tons of ore per day. The Molybdenum Products Corporation spent several hundred thousand dollars and built a 300-ton mill.

In England and France molybdenum was for a while used to replace tungsten at a time when tungsten was hard to get, consequently the price of molybdenum concentrates rose very high. Germany could get much less tungsten than formerly and was even more anxious than the Allies to get molybdenum. Norway, being in an advantageous position, could obtain a very large price for its molybdenite from Germany, and rather than proceed to rationing, as was later done with Sweden, the Allies took all the Norwegian molybdenite at $4 a pound. In this country airplane crankshafts and driving rods were made of molybdenum steel, and one great automobile company made plans to replace vanadium steel by molybdenum steel. The Government, shortly before the armistice, planned to make thin molybdenum steel armorplate, though actual manufacture was never begun.

Inklings of these uses became common rumor, and naturally it was felt that the day of molybdenum had come. But the war ended, the uses were largely discontinued, markets flattened, and now there is little sale at any price for molybdenum concentrates.

However, the Climax Molybdenum Co., the Crucible Steel Co., and others have carried on a remarkable series of experiments that seem to show real use for molybdenum in steel, a new automobile company is making an automobile with molybdenum steel, "Mo-*lyb*-denum" steel shovels are advertised, and it looks as if we

[1] Chromite in 1920: U. S. Geol. Survey Mineral Resources, 1920, pt. 1, p. 25, 1921.

[2] Westgate, Lewis G., deposits of chromite in Stillwater and Sweet Grass counties, Mont.: U. S. Geol. Survey Bull. 725, 1921, pp. 67-84.

[3] Mathews, John Alexander, manufacture of tool-steel: U. S. patent 779,171, Jan. 3, 1905.

EIGHTY-YEAR OLD PROSPECTOR
And his molybdenum prospect, Emigrant Creek, east of Chico, Montana

EUREKA
Prospector has found carnotite ore, from which radium is extracted, in the La Sal Mountains, Utah

may again see a market for molybdenum, the metal to be used in fractions of a percent in spring and axle steels and in other steels, very much though not entirely as vanadium is now used.

VANADIUM

Vanadium is the great homeopathic remedy for steel. The history of vanadium production and smelting is romantic but can not be related in detail here. It had been known for a long while that steels and wrought iron made from vanadium-bearing ores were of unusually good quality, but vanadium deposits were scarce, and those known were small. The first large vanadium deposit found, that of Minaragra, Peru, is still the largest known, and for 10 years has supplied most of the vanadium used in the world. When the Flannerys and their friends undertook the exploitation of the Minaragra deposit they also had to carry on a considerable advertising campaign, and vanadium sold at about $5 a pound for the vanadium contained in ferrovanadium. The metallurgy was very little understood, and at first a third less than half of the vanadium of the ore was obtained in the ferro. After the use of ferrovanadium had become fairly well established, the roscoelite deposits in southwestern Colorado were found, and their exploitation was begun by a New York firm which later sold its interest to the Primos Chemical Co. The Peruvian ores are very rich and as mined at that time carried about 45 percent V_2O_5, but the Colorado ores, although comparatively lean, are in a country that is comfortably habitable, and are close to the railroad. The Peruvian ores occur in bleak mountains at an elevation of about 15,500 feet, 26 miles by trail from a railroad, and until this year the ore had to be carried to the railroad on llamas. The Peruvian ore had the disadvantage also of being a sulphide and of containing other metals, such as nickel (said not to be now found in the ore) and molybdenum, so that its metallurgy was much more difficult than that of the pure roscoelite sandstone of the Southwest. Apparently the company thought that by dropping the price heavily competition could be stifled, and they accordingly reduced the price to about $2 a pound. But costs in the Southwest were lower than had been supposed and competition remained and flourished. During the war prices again rose and reached a very high point, one company reporting that in 1918 and 1919 it sold vanadium at about $8.50 a pound for the vanadium contained in the ferro. Since then prices have dropped until quotations of $3.50 or less have been made.

About 60 percent of the world's vanadium has come from Minaragra during the years that the mine has been in operation. The vanadium produced in the United States has not all come from roscoelite, but the carnotite ores from which radium is obtained have furnished a considerable part of the supply, and have made a valuable by-product in the isolation of radium. Some of the ore too poor in radium to be profitable was mined during the high prices for vanadium, and from these two sources, the roscoelite-bearing sandstone and the radium ores, the United States has produced most of the 40 percent of the world's production not made from Minaragra ores. The vanadinites of the Southwest are very attractive and are at first glance tempting as vanadium ores, but they are so variable in composition and usually carry so many elements that are difficult to separate commercially from vanadium that small use of them has been made. Pure vanadinite is a lead chlor-vanadate, but during the formation of the mineral lack of vanadium may be in part made up by phosphorus or by arsenic, and the lead may be in part replaced by zinc and copper or both, so that very complex minerals result, and unless the ore can be obtained in very large quantities so as to allow mixing to a fairly constant smelter charge, the metallurgic processes must be changed so often that it does not ordinarily pay to smelt the ores. Most of the deposits so far found have been small, and all are confined to the oxidized zones of lead veins.

Radium and Uranium

The United States is by far the largest producer of radium and has the largest known reserves of radium-bearing minerals. However, the quantity produced, when compared with that of other minerals, even the most precious, such as gold, platinum, or diamonds, seems absurdly small, for in no other substance is so large a monetary value represented by so small a bulk.

In 1920 the United States produced ore carrying 43.4

WORLD'S LARGEST KNOWN MOLYBDENUM DEPOSIT
The Climax Molybdenum Mine, Climax, Colorado. This mine is situated at an altitude of 12,000 feet.

grams (about 1.5 ounces) of radium, and during the year the nine radium plants of the country isolated and placed in tubes 32.539 grams (1.15 ounces) worth about $3,253,900.

Since 1911, when the first uranium minerals were mined in this country for radium, ore carrying 186.5 grams (6.6 ounces) has been mined and shipped to reduction plants, and salts containing about 125 grams (4.4 ounces) of radium have been extracted in this country. Before the Great War some ore was shipped to Europe, and the radium was extracted in France, Germany, and Scotland. The quantity extracted abroad was probably not more than 10 grams, though this is a mere guess. The remainder of the 186.5 grams of radium was probably lost, for at first the quantity extracted in some plants was less than 50 percent of the radium in the ore. Probably 25 percent of the total output has been dissipated on watch faces, signs, etc., mostly during the war; some has been exported, and only 80 or 90 grams (3 ounces) has been placed in the hands of physicians and in hospitals. The pitchblende mines of Bohemia (Czechoslovakia), the importance of which has been greatly exaggerated in the public mind, had produced to the end of 1920 a total of 20.962 grams of radium (Ra). Europe probably almost exhausted its radium supplies by wasting uses similar to ours during the Great War.

Three states produce radium-bearing minerals in commercially valuable quantities—Colorado, Utah, and Wyoming—but Colorado produces nearly nine-tenths of the whole. Nearly all the Colorado ore carries carnotite (hydrous potassium uranium vanadate) as the uranium mineral, and it is mined in the southwestern part of the State, near the Utah line, between Gateway on the north and Cedar on the south. A little pitchblende (uranium oxide with some rare earths) has been mined near Central City. In Utah uvanite (hydrous uranium vanadate) is mined at Temple Rock, 45 miles southwest of Greenriver, and carnotite is mined near Thompsons and Moab. In Wyoming uranophane (a hydrous uranium silicate) is mined at Lusk. Efforts were made in 1920 to mine torbernite (hydrous copper-uranium phosphate) near Silver City, N. Mex., but the deposit was too lean to afford a profit. The mineral is now being used in a sanitarium at Silver City for the treatment of disease.

No large deposits of radium minerals are known outside of the United States. Some pitchblende has been mined in Austria, England, and Germany; autunite (hydrous calcium-uranium phosphate) and torbenite have been mined in Portugal, Madagascar, Tonkin, and South Australia; some tyuyamunite (hydrous calcium uranium vanadate) has been mined in Russian Turkestan; and a little carnotite and some obscure radium minerals have been mined in South Australia. Betafite, a complex mineral carrying tantalum, columbium, titanium, and about 18 percent UO_3, has been mined from decayed pegmatites in Madagascar as a radium ore, but only on a small scale. From the ore mined at all these deposits probably less than 40 grams (1.4 ounces) of radium has been isolated.

The whole stock of radium in the world today is probably not more than 100 grams (3.5 ounces). A hundred grams would be worth $10,000,000 to $12,000,000. An equal value in gold coin would weigh from 17 to 20 tons

The recognition of the value of radium in the treat-

ment of certain forms of cancer, of lupus, of fibroid and some other tumors, cheloids, birthmarks, and other diseases is growing. In 1920 the State of New York bought for its Institute for the Treatment of Malignant Disease at Buffalo two grams of radium, and the City of Philadelphia has recently bought two grams.

That other large quantities may be purchased by other states and cities and thus make this marvelous substance available to all those suffering from the ailments for which it is beneficial, is devoutly to be wished. In spite of optimistic estimates by some, recent investigations seem to show that our probable supplies are so small that they should be carefully conserved and no radium should be used for illumination. It seems sure that radium should sell at a higher price than it has recently brought, probably not less than $120 per gram.

Titanium.

Titanium is another element which has attracted the attention of experimenters in the metallurgy of steel and other alloys for many years. It is found in this country in large quantity, both as the mineral rutile (TiO_2) and as the mineral ilmenite ($FeTiO_3$). The ilmenite is in most deposits mixed with magnetite or hematite, so that the percentage of titanium present is not very large. Titaniferous iron ore is found in great quantities in the Adirondacks and near Hartville, Wyo., and in smaller bodies at several points in the South. The largest rutile bodies known are those of Roseland, Nelson County, Va., where for 25 years rutile has been mined by the American Rutile Co. and its recent successor the Thermit Metal & Alloys Corporation. An unsuccessful attempt was made to obtain rutile from deposits on the Florida coast, where rutile and ilmenite have been concentrated naturally in sands derived from the gneisses of the southern Apalachains as these rocks have been gradually worn down by ages of weathering. Competition in the production of rutile has heretofore come from Kragero, Norway, but it seems possible that it may hereafter come from Madagascar also. A long dispute has taken place between rival manufacturers as to whether ferrotitanium containing carbon or carbon-free ferrotitanium is the better. Unfortunately neither alloy has obtained the prestige or the large consumption that its advocates had hoped. Titanium is used in the manufacture of both rolled steel and cast steel to rid the steel of absorbed gases, both oxygen and nitrogen.

During the war both the United States Government and the French Government used rutile to make titanium tetrachloride, a fuming mixture which when exposed to moist air forms dense white clouds of titanium hydroxide, setting free hydrochloric acid, so that if ammonia is added to the mixture the cloud is made more dense by ammonium chloride. These artificial clouds were used for hiding vessels and troops. Rutile is also used for making the electrodes for arc lamps, and potassium-titanium oxide and other salts are used for tanning and dyeing leather.

Nickel

Of nickel the United States produces very little. Only one firm, the Missouri Cobalt Co., at Frederickstown, Mo., is making nickel from American ores, though a few hundred tons is saved annually as a by-product in the electrolytic refining of copper. Our principal supply has come from the great deposits of Sudbury, Canada, the most productive of which have been owned and operated by the International Nickel Co. Before the war this company had only one strong competitor, the Mond Nickel Co., but during the war the British American Nickel Co., in which the British Government held a large amount of stock, was organized. What its role will be in future competition can not now be foretold. A little nickel is also brought to the United States in the form of matte from New Caledonia.

Cobalt

Cobalt, as a metal, has found extensive use only since the invention of high-speed steel and stellite. It had before that been used only a little in bug poisons, for coloring glass and pottery, and in chemicals. Most of the cobalt had been obtained as a by-product from the mining of nickel at Sudbury, and later as a by-product in silver mining at Cobalt and as a by-product of the electrolytic refining of the blister copper from Katanga, Africa, which carried as much as 4 percent of cobalt.

After the development of stellite the Haynes Stellite Co. took over deposits on Blackbird Creek, Idaho, about 16 miles southwest of Salmon. These deposits had been found years before by John Belile, who sent the mineral to the United States Geological Survey for determination, but after being told that it was cobalt, he had to wait for the invention of stellite before he could find a purchaser. The Missouri Cobalt Co. has also been producing cobalt in the form of oxide and hydroxide from the mixed sulphides at Frederickstown, Mo.

Several companies started to make high-speed steels containing cobalt, but being threatened with lawsuits by the German who owned a patent on such steels, they dropped its use. Cobalt steels apparently have so many advantages, however, that they will again be manufactured, and the use of stellite is growing so rapidly that a market for cobalt is apparently assured.

Tin

Tin, although not a rare metal in the general sense of the word, is of rare occurrence in the United States, being one of the very few metals with which we are not richly supplied. It has frequently been suggested of late, however, that if a sufficiently high tariff were placed upon it more and larger deposits would probably be found. To this view exception must be taken. This country has been so well prospected, cassiterite, the universal tin mineral, is so easily identified, and the mineral so readily forms placers because, like gold, it is heavy and does not alter on exposure, that it does not seem probable that any large deposits are yet to be found. The only productive deposits in the United States are the placers on Buck Creek, Alaska. A great deal of money has been spent on the lodes in the inhospitable mountain behind Cape Prince of Wales, and millions have been sunk in the deposits of the Black Hills and Temescal, Calif. Other vigorous attempts have been made to mine tin in Virginia and the Carolinas, and a few tons have been produced. All these fields have been prospected well enough to show that no great quantity of tin can be expected from them, and the United States must continue to obtain its supply from abroad.

HOW THE LEASING ACT IS ADMINISTERED

By H. Foster Bain
Director of the United States Bureau of Mines

AT THE DENVER MEETING of the American Mining Congress, Mr. Clay Tallman, then Commissioner of the General Land Office, presented a clear analysis of the mineral leasing act of February 25, 1920, with a comprehensive review of the conditions that led to its enactment. The new law has now been in operation more than a year and the Department of the Interior has developed a system for its administration designed to place the full resources of the department at the service of the government and the lessee who, in a sense, becomes the business partner of the government under the new law. The active part taken by the Mining Congress in shaping this legislation and the help given by its officers and members to the department in shaping the regulations, warrant a rather full statement of the scheme of administration that has been adopted.

The General Land Office retains full responsibility for all matters of title and legal interpretation and receives all moneys paid as royalties. The Geological Survey has important responsibilities to face in the classification of the land, the laying out of leasing blocks and takes the initiative in recommending rates of royalty. The Bureau of Mines maintains the field force which supervises the actual mining operations, to the end that the interest of the landowner, in this case the government, shall be maintained and the work conducted in a workmanlike manner with the minimum of waste. The First Assistant Secretary of the Interior, Mr. E. C. Finney, whose interest in the whole matter is keen and unflagging, acts as co-ordinator of these various activities and is in immediate charge of leasing matters under the Secretary.

DR. H. FOSTER BAIN

In addition to the Act of February 1920, leasing on the public lands is conducted under the terms of the potash law passed two years earlier, under a special act for Alaska, under compromise agreements in settlement of suits for trespass; and under provisions for leasing Indian lands, and Naval reserves. While the procedure differs under these various laws the general scheme is beginning to run through all and probably what is now being developed will become standard practice.

Up to July 1, 650 applications had been filed for coal prospecting permits, 113 for coal leases and 13 for coal licenses. At the same time 12 applications for oil shale leases had been received, 20 for phosphate lands, and 10 for sodium permits. The largest activity was in gas and oil where of 11,055 applications for prospecting permits received, 3,256 had been granted, 1,537 withdrawn or finally rejected, 3,762 rejected subject to appeal, and 2,500 remained to be acted upon.

The General Land Office has been handicapped on account of the lack of appropriations but an immense amount of work has been handled. Upon passage of the act, many applied immediately for prospecting permits and in some cases as many as 25 filed on the same tract of land. Such a number of applicants complicated and delayed the handling and granting of prospecting permits. Not much more than 1 percent of the applications were clear and complete. There were conflicts with state indemnity lands, power site withdrawals, rights of way, reclamation sites, forestry withdrawals, homesteads, railroad selections, desert land selections and privately owned land. As these matters are adjusted or otherwise removed the applications for oil or gas permits are referred to the Geological Survey to determine whether the land is outside a known producing oil or gas geologic structure. Upon certification to that effect by the Survey the General Land Office recommends to the Secretary of the Interior the granting of a prospecting permit.

When the operator discovers oil or gas, he must notify the General Land Office and apply for a lease, which, if there are no conflicts, is granted at a 5 percent royalty for one-fourth of the area in the permit, or if one-fourth of the permit is less than 160 acres, then the operator is given lease to 160 acres at 5 percent royalty. The operator also has a preferential right to lease the remaining three-fourths at a sliding scale royalty. Leases are also granted without previous prospecting where the Geological Survey certifies the land to be within a known producing oil and gas structure.

Many of the lease applications are so-called relief cases and in such the titles to the mining claims must be ascertained by examination of the abstracts that the status of the land may be determined and conflicts adjusted. The Geological Survey reports as to the character of the land. A special field agent must report as to the bona fides of mining claims, improvements made upon or for the benefit of such claims, amounts of back production, if any, and other similar questions. The procedure as to existing homesteads and other non-mineral entries, filings, or selections is set out on page 14 of General Land Office Circular 672 and cannot be condensed easily.

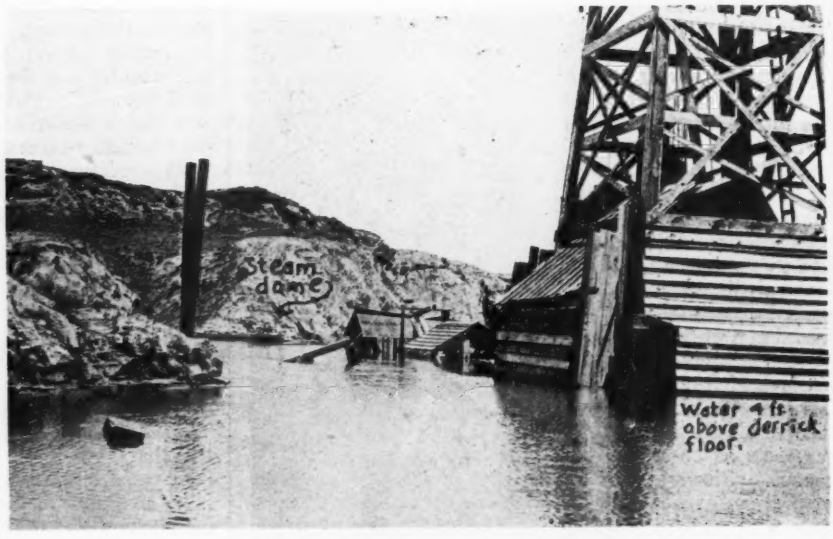
After all defects in the application have been corrected and conflicts removed or adjusted, and the applicant found to be qualified to receive a lease, the application is transmitted to the Secretary of the Interior, accompanied by a letter setting out all the salient facts of the case and accompanied by appropriate recommendations. If a lease is recommended and the recommendation is approved by the Secretary, the lease is drawn up in triplicate and sent to the lessee with instructions as to settlement of back royalty, interest, rental, dismissal of suits, distribution of escrow funds and impoundments by appropriate instructions to depositary banks, in the case of escrow deposits, and correspondence with the Department of Justice, in case of impoundments held by the courts receivers.

In compromise cases a report with recommendations is made to the President. If approved by the President, the case then follows the usual procedure. If the compromise case affects the naval petroleum reserves in any way the Secretary of the Interior collaborates with the

Navy Department before making his recommendation to the President.

Upon the completion of all settlements of amounts du to the United States and the return of the triplicate copies of lease duly executed by the lessee with proper bond, these are transmitted by the Commissioner of the General Land Office to the Secretary of the Interior with a report for execution of the lease by the Secretary. Upon return of the executed lease to the General Land Office, it is entered upon the records there and one copy sent to the lessee. The Bureau of Mines is also furnished with copies of all leases and in the case of oil, the Shipping Board (which buys the Government royalty oil) is advised, as well as the Registers and Receivers of the district in which the land is situated. The Navy Department and Mr. W. C. Mendenhall of the United States Geological Survey are notified if the land is in a naval petroleum reserve.

The Geological Survey must distinguish between prospecting territory and leasing territory on all the land covered in the Leasing Act, lay out leasing blocks and recommend the amount of royalty in the case of coal, the propriety of the issuance of a lease and reasonableness of the acreage in the case of phosphate, the proper type of right in case of sodium, and the propriety of issuing prospecting permit and later the sufficiency of the claim of discovery of potash. In the case of oil and gas, the act provides that territory in a "known geologic structure of producing areas" is subject for lease only. Outside lands may be covered by prospecting. Thus far, 34 producing structures have been officially defined in the public-land States. An applicant may be granted not more than three prospecting permits in one state and not more than one permit on each structure. The Survey reports on all applications, first, as to whether they are within or without a producing structure; and, second, if there are two or more applications filed by a single individual, as to whether they are on the same or separate structures. During the fiscal year of 1921, the Survey made about 7,000 reports under this part of the act.



WHERE RIGHTS OF HOMESTEADERS AND MINERS CONFLICT

The administration of the Leasing Act becomes complicated where a grazing homestead entryman and a mineral lessee operate on the same land. This photograph shows the condition which resulted when a homestead entrant placed a dam across a gulch. Rain flooded the derrick floor, covered the boiler and put the miner's machinery out of commission

Section 12 (c) of the regulations (Circular 672) requires that under certain circumstances the lands included in homestead entries shall be classified as to their prospective oil value in order that it may be determined whether the homesteader shall be limited to surface state or not. These classifications must be made by the Geological Survey.

The organization of the Bureau of Mines for administering the oil leasing act is largely in the oil fields throughout the United States. The Director of the Bureau is in responsible charge of the work, working through the chief petroleum technologist on technical matters, while the executive secretary handles routine matters. The chief oil and gas supervisor, who reports to the chief petroleum technologist, is in charge of the field work and has headquarters at Denver, Colorado. Local field offices with deputy supervisors in charge have been established at Casper, Wyoming; Winnett, Montana; Shreveport, Louisiana; and Bakersfield, California. The total personne of the oil and gas leaking work of the Bureau of Mines comprises about 26 employes and is composed of engineers, drillers, oil gagers and oil clerks. When the Secretary of the Interior grants a prospecting permit or lease the Bureau of Mines notifies the appropriate field office. In the case of a producing lease, the field men of the Bureau supervise drilling and production, gaging of oil and the metering of gas, and compute the royalty due the government.

The supervision of drilling, both on leases and on prospecting permits, requires careful watch of the progress in order to make certain that each well is drilled so as to prevent waste of oil or gas, whether it be through flooding of the productive sands by water, or through allowing the escape of oil or gas into barren sands. In the case of prospecting permits, if it is thought that any possible oil sands have been passed by without testing, the Bureau engineers must see that these are protected against damage by the use of casing, properly set either with mud-laden fluid or cement. If a test well proves to be a non-producer, it is the duty of the Bureau engineers to see that it is properly abandoned. In cases where a hole is in need of repair, it may be necessary for the Bureau force to direct the repair work on the well.

In California, the State Mining Bureau has an excellent organization of field engineers for the supervision of the drilling of wells. Here the government co-operates closely with the state organization and as far as the drilling of wells is concerned takes the position of a land holder rather than a supervisor. This avoids annoyance to the operators and duplication.

The oil produced on a lease is run to tanks where it is gaged before being run by the pipe line. The Bureau does not have a force large enough to gage every tank of oil, and the pipe line run tickets of the company are usually accepted, but the government gagers are present at a sufficient number of runs to check the general production on any particular lease and to see that there are no large errors in gaging. The production from any lease soon becomes constant enough for any large difference to be

promptly noticed. Besides, the producing company usually sells to a pipe line company and often both have their own gagers on hand at the time the oil is gaged.

Each month a statement is sent to the field office of the deputy supervisor showing the amount of oil run from each lease, and from this statement computations are made as to the amount of royalty oil due the government and its value. In most cases the pipe line company runs the entire production from the lease.

Except for compromise leases, the usual royalty percentage for oil is on a graduated scale which becomes higher with an increase in the average production per well per day for the month, also with an increase in the Baumé gravity. The Bureau has prepared a set of royalty computation tables which operators can use in computing royalty due the government.

The royalties from natural gas may be from two sources, (a) revenue from the sale of dry natural gas, and (b) revenue from the sale of casinghead gasoline manufactured from the natural gas. If the average production per well is over 3,000,000 cubic feet of gas per day for the month, the royalty is one-sixth of the value, while if under that figure the royalty is one-eighth. Where the operator manufactures casinghead gasoline from the natural gas, the operator is allowed two-thirds of his total receipts for plant operation and a royalty of sixteen and two-thirds percent is taken upon the remaining one-third. In the Rocky Mountains transportation is difficult, and the winters are severe, so the Department allows the plant operators a higher fraction for plant operations.

A WYOMING GAS WELL

Showing the escape of water between casing and tubing. Water may do great damage to the oil or gas sands, and it is the duty of Bureau of Mines engineers to see that wells in this condition are repaired

The oil and gas companies pay their royalty money to the receiver of the local land office of the district in which the land is located. The local receiver turns this money into the U. S. Treasury and sends in a statement to the General Land Office at Washington, D. C., of the amount received from the various companies. The General Land Office audits each account and determines whether each lessee has paid the proper amount according to the statement issued by the Bureau of Mines.

Under an executive order of May 31, 1921, the President committed the administration and conservation of the Naval Petroleum Reserve to the Secretary of the Interior. It is estimated that Naval Petroleum Reserve No. 2 in California produces 8800 barrels of oil per day at present, which must be gaged in order to determine the royalty oil due the United States. Leases have been granted recently to the United Midway Oil Company and the Pan American Petroleum Company which require drilling 22 additional wells on Naval Petroleum Reserve No. 1. It is probable that within the next year there will be a production of 30,000 barrels per day inside the Naval Petroleum reserves in California. The government reserves the right to take its royalty in kind, and as a result the Navy Department will probably arrange with certain companies to exchange the royalty oil from the naval reserves for an equivalent value of fuel oil at the sea coast.

At the present time the Shipping Board has an agreement with the Department of the Interior whereby it buys from the government the royalty oil produced on government lands in Montana and Wyoming. The Shipping Board does not actually take the crude oil produced in the field but has arranged with the Midwest Refining Company to deliver to the Shipping Board on the Pacific Coast, a fuel oil of equivalent value. This is done by means of an agreement between the Midwest Refining Company and the Standard Oil Company of California at the Pacific Coast. Where the royalty oil is sold to the Shipping Board, the Department of the Interior bills the Shipping Board for the royalty oil and the Shipping Board pays this to the Department of the Interior, the money being handled in the same way as the royalty money is handled.

In a work of this magnitude many unexpected and difficult problems arise. For example, what is the value of natural gas at the well in a field with a very limited market and practically no competition, such as in the Poison Spider field, in Wyoming? In considering such a question the Department must exercise considerable discretion in order to be just both to the companies and the government. What also is the value of the casinghead gasoline in an isolated district? In the Salt Creek field, Wyoming, the Midwest Refining Company enjoys a practical monopoly. The gas department of this company manufactures and sells its casinghead gasoline to the refining department. In California and Oklahoma, where there is considerable competition, the actual sales price which the operator receives for his casinghead gasoline is an index of a fair value but in Salt Creek field it was necessary to determine the value in some other way. This problem was complicated because of the isolation of the Midwest Refining plant. The plant may be shut off from transportation during the severe winter months. The field is 45 miles from a railroad and it was necessary to build a special pipe line to the railroad for transportation of the casinghead gasoline to the market and transportation costs are high. A problem of this sort involves considering the costs of the original investment, maintenance, depreciation of the plant, as well as net returns. It is not fair to compare conditions existing at Salt Creek with those in California or Oklahoma where the plants are near the railroad, and where there is a great deal of competi-

tion and a ready market. I may add that in this case it was decided to accept a certain percentage of the Chicago tank wagon price for gasoline.

The administration of the leasing act is complicated in some areas where there is a grazing homestead entryman as well as a mineral lessee on the same land. In one particular case the operator placed his derrick in the bottom of a gulch. Later the homestead entryman built a dam across the bottom of the gulch for the purpose of collecting water. Following a rain the water flooded the derrick floor and covered the boiler. Drilling stopped and the rights of the homestead entryman and the oil lessee are still undecided. The surface entryman and the mineral lessee may have troubles over fences and in many minor particulars the Department is called upon to preserve the equities as between various parties.

Operators have in general been keen to follow the regulations but in a few instances have placed derricks less than 200 feet from the section or boundary line, which is against the law. In one place an operator started to drill a well more than 50 feet within the 200 feet limit and after drilling several hundred feet he was instructed to move his derrick and abandon the hole. The Department wishes to be lenient with operators up to the point where the action of the operator breaks the law or where the operations result in unnecessary waste. The general attitude of the Department is that the companies are copartners with the government in developing these large natural resources.

The General Land Office has issued Circular No. 672 entitled "Regulations Concerning Oil and Gas Permits and Leases and Rights of Way for Oil and Gas Pipe Lines" which describes in general the different sections of the act and regulations for the administration of that part of the act relating to oil and gas. Copies of this circular may be had upon application to the Commissioner of the General Land Office, Washington, D. C. Thus far, the Bureau of Mines has issued three pamphlets in connection with the oil leasing act. These are (1) "Operating Regulations to Govern the Production of Oil and Gas" (2) "Plan for Conducting Work Under Operating Regulations to Govern the Production of Oil and Gas," and (3) "Tables for Computing Oil Royalties under the Leasing Act of February 25, 1920," copies of which may be procured upon application to the local field offices of the Bureau of Mines or upon application to the Director of the Bureau of Mines, Washington, D. C. By a study of the General Land Office circular and the information furnished in the three Bureau of Mines publications, the operator may gain considerable information as to the method of making application for prospecting permits and leases and of conducting work after securing a permit or lease.

The operations in the oil and gas fields have been described at length since at present they mark the major activity under the leasing act. The act, however, covers several other minerals and the other leasing laws throw upon the Department responsibilities of a wide range. It is probable that the coal fields will be more important than the oil fields and careful preparation is being made for caring for this work as it develops. The course of applications for permits and leases on coal lands through the General Land Office is the same as those for oil and gas and the possible conflicts and difficulties are the same. The coal sections of the act provide that prospecting permits may be issued where exploratory work is necessary to determine the existence or workability of coal deposits and that leases will be issued in other cases. The Survey reports on each application as to whether lease or permit should be issued. If the land is to be leased the law requires that leasing tracts be created either upon the Secretary's initiative or upon that of the applicant. The Survey is required to recommend to the Department appropriate leasing blocks or tracts. A proper royalty must be fixed in each lease issued. A minimum investment to insure operation by the lessee must also be established, and a minimum royalty, determined by a minimum tonnage to be mined each year, must also be specified. The Survey is required to advise the Department as to all these elements since in order to avoid misunderstandings with lessees it is desired that they be determined in advance. After the leases are issued the duty of supervising operations falls upon the Bureau of Mines, and, therefore, the engineers of the latter co-operate with the geologists of the Survey in making the determinations indicated. About 350 reports have been issued during the last fiscal year under the coal sections of the law and field studies, conducted jointly by the Bureau and the Survey to determine doubtful points, are now under way in the more important coal fields. Before issuing many leases in any field it is necessary to mark out virtually all the blocks that will be granted in order to divide as fairly as may be possible the natural facilities for mining and insure equality of access. These and many other problems come up in making the attempt to establish conditions which will permit mining on the government land with the maximum of economy and minimum of waste of coal.

The government is interested in low costs as these induce maximum tonnage, consequently greater royalties. The government is also interested in seeing that small or large tracts are not isolated by surrounding them with leased and patented lands, or by cutting off the logical points for economical development or transportation. The leaving of small tracts on outcrops is desirable when on transportation lines in order to supply the demands of small operators with little capital, but such small outcrop tracts should be included in leases when at distances from possible transportation lines. Where adjacent mines could each advantageously mine the coal in a connecting territory, the land must be divided into two or more blocks so that either party could by competitive bidding, bid in only that part or parts which are of economical importance to his respective mines without the necessity of injuring his neighbor. The lessee should not be permitted to acquire an undue amount of outcrop or cheaper mined coal, nor should be permitted to isolate coals under greater cover or to make the initial cost of developing them prohibitive. Applicants for land usually ask for such lands as have not already been applied for without reference to economical units. It would be much better for each to apply for the land desired, irrespective of the applications of others. In these cases it may be advisable to discard the lines drawn by applicants and to set up logical units and permit the interested parties to amend their applications to include one or more adjacent blocks providing the maximum acreage is not exceeded.

Some applications show a stock selling campaign to be in view. Others ask for maximum acreage where the markets are very limited, thus exposing the operator to the liability of having to pay minimum royalties greater than the maximum production. Other applicants plan to secure lands with maximum timber, to control waterways or outcrops on both sides of a canyon. On one occasion an application covered both sides of a canyon along one side of which the land asked for did not exceed 800 feet from the outcrop and extended more than a

mile along it. Many of the applicants, however, show selection of lands to have been made by mining men and their engineers with the one view of economical mining and maintaining their reserve. The Bureau of Mines enforces the Coal Leasing Act after the leases have been granted. There are now two operators producing under government leases, both in Wyoming. Several leases have been paid for, and within a short time should become operative. Many of the operators adjacent to government lands have made applications for coal lands. The leasing of coal lands will shortly be an important government function and the leases a welcomed source of revenue.

In making recommendations for improving mining methods or safety conditions the most important factor is going to be the attitude taken by the miners themselves as to changing working conditions. Practices considered safe and economical in coal beds with less than 500 feet of cover are neither safe nor economical under a cover of 2,000 feet and radical changes must be made as the dust becomes drier and gas appears. Under these conditions use and kind of explosives must be modified as well as ventilation and lighting methods. The changes will be rather ones of proportion.. In order to conserve the more economically mined coals, methods must be adopted which will increase the production per acre.

The government is now in the same position as a holding company with a large number of lessees and in order that the work may be conducted intelligently over a long period of years through many changes in market conditions and mining conditions it is necessary to obtain and keep most complete records. Complete working data is also of importance and it is hoped that the lessees will enter into the spirit of the plans and record accurately all conditions. Inspection will be made at frequent intervals to maintain safe practices and obtain the maximum recovery. The production of coal will be checked and as conditions warrant the mines may be surveyed.

The headquarters of the Bureau of Mines inspection force for coal and minor minerals has been placed at Denver, with reports passing through the office of the chief mining engineer at Washington. As need arises mining engineers in the several districts employed on other activities are detailed for the inspection work. Operating regulations covering coal mining have been published under the title, "Operating Regulations to Govern Coal Mining Methods and the Safety and Welfare of Miners on Leased Lands on the Public Domain under Act of February 25, 1920 (Public No. 146)." Copies may be obtained through the Director, U. S. Bureau of Mines, Washington, D. C. While they may seem voluminous at first glance it was thought better to plan definitely for the conditions to be met in advance of signing each lease and to leave no unnecessary discretionary authority in the hands of field subordinates as a possible source of friction. Coal mine inspection has been conducted many years in America and there is a basis of experience in regard to it that does not obtain in the case of the other minerals covered by the leasing laws. The Department regulations are simpler and less drastic than those of several of the states and it is recognized at all points that the state inspection laws take precedence.

Regulations covering mining for phosphate, oil shale, sodium and potash have been drafted and are in process of being circulated for criticism prior to being placed in final form. Mining of these minerals on the public land is as yet unimportant and since most of the desirable oil shale lands were acquired under the placer law prior to passage of the leasing act, the number of mines of oil shale to be considered is not likely to be large.

The magnitude of the operations now conducted may be illustrated by figures of the production of oil and gas. Up to and including June 30, 1921, $9,703,438.99 had been collected for royalties and bonuses and paid into the Treasury of the United States. A considerable amount of royalty from back production remains to be collected. During the year 1921 probably 12,000,000 barrels of oil will be produced from the wells on Government land and about 2,000,000 barrels of this will be due the Government as royalty oil. Up to July 1, 1921, 11,055 applications had been received for prospecting permits and of these all but 2,500 have been acted upon.

The act provides that 10 percent of the royalty received is retained in the Treasury of the United States. All money for royalty oil produced in the naval petroleum reserves is credited to miscellaneous receipts in the Treasury. Up to and including June 30, 1921, this amounted to $3,117,963.05. The balance of the $9,703,438.99 collected or $6,585,475.94 is to be apportioned as follows: The reclamation fund receives 70 percent of the past royalty money collected and 52½ percent of the future royalty collected. The various states in which the oil is produced receive 20 percent of the past royalty and 37½ percent of the future royalty. This money is to be expended by the states for public roads and schools. By the term "past royalty" is meant the royalty money due for production prior to the date of granting the lease and "future royalty" indicates the money due for production after the date of granting the lease.

Large sums of money are being turned over to the various states and it is apparent that the government has the responsibility of not only protecting its own interest but in addition that of providing for the states' interests. The Department of the Interior must be vigilant in providing for the proper development and conservation of the mineral resources effected for the purpose of obtaining a maximum revenue both present and future for the different states. Upon the fidelity with which this trust is fulfilled will depend in an increasing degree the amount of money available for roads, schools, and the making of homes in the West. Conscious of this responsibility, the officers of the Department and the Bureaus immediately concerned are making every effort to establish a simple and effective system of administration with the minimum of cost and interference. The keynote of the service is that the Department is now an active partner in development of the West.

J. F. CALLBREATH,
Secretary, The American Mining Congress

The American Mining Congress

was organized in 1898. From a purely "gold mining congress" it has grown to represent the whole mining industry, and today is the "Mining Industry Chamber of Commerce."

Its first great effort resulted in the creation of the United States Bureau of Mines. Through that Bureau thousands of lives have been saved through safety work, and the adoption of the slogan "Safety-First" has become nation-wide.

The provision in the revenue law which permits the deduction of the full value of the ore in the ground, rather than the 5 per cent limit provided in the law of 1913, is the result of determined effort and diligence on the part of this organization.

There are 27 minerals seeking a protective tariff. They are presenting their needs to Congress through the non-partisan channels of a well-balanced organization, which is making available for members of Congress well authenticated data upon which to base the protection sought.

The American Mining Congress has eight well equipped divisions: (1) The Division of Mineral Tariffs, which will furnish you with complete data concerning any of the twenty-seven minerals it represents. (2) The Tax Division, which may be consulted upon the many and intricate problems confronting the taxpayer. (3) The Bureau of Mining Economics, which is equipped to furnish you with reliable data upon any phase of mining. (4) The Legal Division, which will assist in preparing briefs to be presented to Government departments, and inform you of the status of legislation, pending and passed, the application of laws, and such legal matters as come within our province. (5) The Standardization Division, which is making a study of standardization, both national and international, and whose great effort is simplifying mining methods, practice and equipment. (6) The Daily Information Service, which keeps mining men informed of all mining news emanating from the national capital, whether legislative or departmental. (7) The Division of Precious and Rare Metals, which has made a special study of gold mining conditions, and which will assist in every possible way in the development of these industries. (8) The Mining Congress Journal, the monthly publication which carries a complete resume of national legislation, and 50,000 words of the livest mining news published.

Its presidents all have been leaders in the mining world: Hon. J. H. Richards, Dr. E. R. Buckley, John Dern, Samuel A. Taylor, David W. Brunton, Carl Scholz, Walter Douglas, Bulkeley Wells, W. J. Loring.

It is pledged to "At all times seek the best welfare of the mining industry, and to exert every legitimate effort to secure for that industry the recognition to which it is entitled" as the one indispensable industry.

ANNUAL REPORT OF THE COAL EXPORT COMMITTEE

New York, Sept. 1, 1921.

THE EARLIER ATTEMPTS made in 1920 to organize a Coal Export Association having been tabled on account of the rapidly varying foreign market conditions and the erratic fluctuations in shipping rates and foreign exchange, which caused many of the large operating companies to keep their personal representatives abroad, the work of the Coal Export Committee during the past year has been devoted to obtaining the most complete possible information which could be of interest to the coal branch of the mining industry, and placing the same promptly before the trade.

In this way, the chairman's desk has gradually become a sort of clearing house for export coal information over which pass the reports of the various foreign trade commissioners in response to the American Mining Congress' questionnaire previously sent out.

Shipping rates, embargoes, foreign port labor conditions, credit conditions, reports on new equipment installations for discharge, etc., in similar manner are made available, and are frequently summarized in the "Journal."

The committee has thus met a demand for authoritative information and has placed on record for the use of the coal industry certain data never before obtained in this country. The continuation of this work it is believed is highly essential.

As a result of the information so obtained, and of private correspondence, and conferences with prominent coal operators and engineers who have recently returned from Europe and South America, it now appears that an export organization such as was proposed in 1920, is needed badly. Mr. Chas. A. Owen, president of the Tidewater Coal Exchange, Inc., and of the Imperial Coal Corporation, says that a strong organization of American coal exporters, working in close co-operation with the government and the shipping industry is the only way for us to handle the exportation of American coal, and such an organization must have the active, practical co-operation of sound financial institutions.

Such an organization already exists in England, and the English have studied the needs of the individual consumer (as was related in the report of this Committee on "Coal Conditions in Sweden," MINING CONGRESS JOURNAL, July, 1921).

It would appear that by delivering high grade American coal at French Atlantic ports at approximately $8.50 per gross ton, we may expect a fair share of the normal French trade. This, according to Mr. Owen, would require ocean transportation at not exceeding $4.00 and railroad freight to tidewater $2.25, leaving only $2.25 to cover cost of coal, insurance, banking charges, demurrage, etc.

To this there is only one answer: Reduced wages at the mines. German coal is being delivered to France at $7.00,–$8.00 per ton, in ample quantities. The difference in price allowed for American coal is the tribute to superior quality. The best English lump coal is being laid down in France at the present time for $11.00.

The South American situation is such that nothing but concerted and co-operative selling can accomplish anything. Freight rates are the lowest in years, and credits of 60 days after arrival are demanded. Brazilian and Argentine credits were formerly in demand but in recent months many quibbles have arisen over technicalities in contracts. The Chilean market demands unreasonable guarantees of analysis and size, which have so far precluded the closing of any large business.

DR. HENRY MACE PAYNE
Chairman of Coal Export Committee, American Mining Congress

In view of the ultimate abandonment of a miner's subsidy by the British government, it is not unlikely that a sufficient rise in the cost of British coal will take place to create a favorable market for American coal. To meet this condition, early action should be taken toward the formation of an American Export Coal Association.

Such an association should work in close touch with Secretary Hoover of the Department of Commerce, and with the Bureau of Foreign and Domestic Commerce, and should endeavor to secure a uniform method of inspection, sampling, analysis, and guarantee of quality, similar to the grain inspection system now in force.

It is recommended therefore that the energies of this committee be directed during the coming year toward the continuance of the "clearing house of information" idea, the creation of an export coal organization, and a system of uniform inspection, sampling and certification as to quality, which will enable American coal exporters to intelligently meet the competition of other countries, establish uniform conditions of credits, and provide for the distribution to its members of all available commercial information to the end that there may be no cut-throat competition on international business.

HENRY M. PAYNE, *Chairman*,
JOHN CALLAHAN,
E. A. HOLLBROOK, *Vice* G. S. RICE,
GEO. A. O'REILLY,
CHAS. S. ALLEN.

THE TARIFF FIGHT

By Herbert Wilson Smith,
Chief of the Tariff Division, American Mining Congress

A WISE and weatherbeaten old half-breed guide with whom I climbed the lonely peaks of the Sierra Ladron in New Mexico taught me in the mountains a method of overcoming weariness which is not to be forgotten. After a hard climb of a hundred yards he would make me turn about and look over the valley and lowlands from which we had come. As we would stand looking back across those purple canyons renewed strength would gradually rise until it swept over me in a flood. It was partly the rest, partly the beauty of the vista, but mainly the sight of the progress we had made that refreshed us and stimulated us to climb further.

In the campaign for adequate protective tariff on the products of our mineral industry we can do the same thing. Three years ago the work of the Tariff Division of this organization was just beginning, and many of the minerals whose cause fo protection was being espoused had never been considered as articles to which principle of protective tariff should properly apply. Today in this brief respite, given by the congressional recess and the consideration of tax measures in advance of the tariff measures by the Senate Committee, we can stop and look back over the road by which we have come. We are a long way from the top; we are a long way from the permanent establishment of protective tariff on many of these mineral industries. But H. R. 7456, known as the Fordney Tariff Bill, has passed the House and is now before the Senate Finance Committee. It contains features of protection for mineral industries which are most encouraging to those new industries which developed during the war and is the most noteworthy recognition of the protective tariff principles for mineral industries advocated by the American Mining Congress which has ever been passed by any legislative body. In working for a protective tariff on any of these mineral industries we have had to raise the entire economic structure above it; we have had to contend against the weight of every industry which is super-imposed above us in the use of the mineral or metal, the finished produet of the miner, as raw material in their own manufactured finished product. We are bound to have the opposition of every one of these industries bearing down upon us, so the achievement of any form of protection is no mean task.

HERBERT WILSON SMITH

For almost two years the ground work was being laid in the development of the basis of information on which the tariffs were to be requested. In January of this year solid phalanxes of business men began to descend upon the Ways and Means Committee of the House; some of them in favor o our issues more opposed to them. Most of them represented the industries which used the materials produced in the mining industry in their own manufacturing process, but the mining industry kept on fighting through the splendid work of its individual members and representatives of the various separate mineral industries. At the conclusion o the hearings of the House Committee a statement in the form of a statistical chart was filed by the Tariff Division of the American Mining Congress with the Ways and Means Committee, giving the following data on all the mineral industries seeking tariff protection.

Present tariff classification; Schedule, Paragraph, Rate, Unit of measure; Imports from foreign countries Prewar, War time, Present (latest available data); countries imported from; Labor cost per diem respectively in those countries; Relative trade balance of those countries with the United States; Present exchange rates of those countries with the United States; Nature and extent of ore deposits: Foreign, United States; Cost of production: Foreign, United States; Prevailing prices: Prewar, War time, Present (latest available data); Annual production in United States: Prewar War time, Present (latest available data); States in which produced; Number of people dependent on this industry for support; Approximate investment; Present condition in this industry and particular problem it is facing; Probable relative percentage of mineral that will be consumed under correct tariff: Foreign, United States; Tariff requested to protect industry; Tariff proposed in H. R. 7456: Schedule, Paragraph, Rate of duty.

This digest gives information on Antimony, Arsenic, Asbestos, Barytes, Bismuth, Cadmium, Chromite, Feldspar Fluorspar, Graphite, Gypsum, Kaolin (white china Clay), Lead, Lime, Manganese, Magnesite, Marble, Mica, Molybdenum, Monazite and thorium, Pyrites, Pumice, Potash, Quicksilver, Talc, Tungsten, Zinc.

The committee made extended use of this chart. The valuable feature which developed was, however, that the committee received the presentations and statements of our tariff division not as selfish requests designed to benefit a special industry, but in their correct aspect, as a presentation of fundamental facts on which the committee was to base its own conclusions.

There were also presented to the committee two charts which showed relative movements of price and production in two groups of mineral industries, protected and unprotected, and prices of finished products from these raw materials, over a period of twelve years.

It was shown that as prices fell, production fell with them until at the low point of the price there was a flat level of non-production, Following low production price starts upward. Production is stimulated thereby until at the high point of price, there is great over-production. Price then starts rapidly down; production follows it until the low point of price is again reached, which means bankruptcy for many operating companies, and a flat level of non-production which accelerates another upward price move.

Under such circumstances the swing of prices is rapid and over a wide area, and the price fixed by the manufacturer who uses these raw materials is based on the top price range, for he must be prepared in the price of his finished product to meet a cost for his raw material represented by the possible high ranges of price.

For example, look at the low prices to which minerals and metals dropped in late 1918 and in 1919; yet the prices of finished goods to the consumer went steadily up and reached their peak early in 1920 when the raw materials that went into many finished products had been bought on the low market of 1919.

Movements in the chart of protected mineral industries follow the same laws of supply and demand but with this vital difference; the industry being protected from extreme low ranges of price by tariff, price does not drop to a point below cost of production. Therefore, production does not fall to the flat level of non-production.

Similarly, as there is no flat level of non-production, there is no rapid stimulation of price The important thing to the consumer is that the cost of the raw material on which the manufacturer bases the cost of his finished product is at a much lower top range of probable price than is possible under the unprotected industries. Tariff, in short, has acted as a huge economic gyroscope in maintaining a smooth running-level in the price and production movement in the industry so protected.

These charts were shown in the March, 1921, number of THE MINING CONGRESS JOURNAL and have been extensively featured in other publications.

The point which they emphasized with the committee is that the consumer does not benefit by the low cost of raw material in rapid fluctuations of price. That the committee was impressed by the truth of this view is shown in a speech later made by Representative Charles Timberlake, of Colorado, in which he says in part:

"Now, the point of these statements is this, where there is a wide range of fluctuation of price of basic raw material in an industry not protected by a tariff there is a much higher actual price cost to the consumer over a period of years on his finished product than there is in the industry which is protected by tar ff and which can figure on its raw material at a level price over a period of years and can make its manufacturing cost and its prices to the consumer over a long period of time.

"Under such wild ranges of price fluctuation we have today free wool and high-priced clothing. We have free lumber and high building costs. We have free importation of agricultural products and high-priced foodstuffs. It was not the purpose of our committee in the framing of this legislation to take any stock in the principles of such industries as appeared before it when those industries would support protection for themselves and every step above them on our economic ladder and want to refuse protection to every industry below them, industries on which they were dependent for the materials which went into their manufactured products, industries which wanted everything they bought on the free list and everything that they sold protected, industries which wanted free ores and protected finished metals, which wanted free manganese ore and protected ferromanganese, free tungsten and protected alloy steel, because we knew that this meant ruin to the mining industries on which these very manufacturing industries were dependent. It meant loss of billions in revenue to the United States, and we knew that over a period of years it meant actually a higher cost to the consumer of every article into which a pound of this metal went because of the extreme price fluctuation which I have just cited."

We have had to controvert the theory that the economic structure of this country is a series of steps, one above the other, with some particular material as the beginning point. We have had to show that the raw material of one industry was the finished product of the previous stage and that our industrial structure is a cycle, not a ladder; that the miner of manganese ore, for example, produces from the raw earth his finished product which goes to the furnace, where it is their raw material from which ferromanganese is made, which in turn is the raw material of manganese steel from which mine machinery and steam shovel buckets are made, which in themselves are used in the reduction of the raw material by the miner to produce his finished product. Chairman Fordney of the Ways and Means Committee in support of this view stated in a recent committee hearing: "You talk about raw material. I will tell you what raw material is, in my opinion—I do not know whether you will agree with me: It is the round world untouched by man. Ore in the ground is raw material. Timber that stands in the woods is raw material. Hide on the back of an animal is the raw material of the tanner, but the finished product of the farmer. The man who wants protection on leather and free trade on hides is not my kind of a protectionist. Leather is the raw material of the shoemaker, but the finished product of the tanner. Cotton is the finished product of the farmer and the raw material of the manufacturer, and so on; you can go all along that line. "Every industry that comes in competition with the cheap oriental and European labor must be protected in order to maintain the standard of life and living in this country."

The bill which has passed the House is, on the whole, greatly encouraging to the mining industry. The issues which have been satisfactorily settled by this bill must be sustained before the Senate Committee. There are revisions to be made in the proposed rates, different rates which are obviously necessary to adjust differences between interrelated industries, protective rates for industries not established in the House to be considered, and we hope, granted by the Senate. These schedules must then be carried through their fight on the floor of the Senate, and through the compromises of the conference committee to ultimately become tariff law.

The tariff commission must complete its exhaustive report on the proposed system of American Valuation before the bill can be completely drafted.

Should the bill not be passed prior to adjournment it will not affect the status From whatever point in its passage it may have reached prior to adjournment, the measure will be continued as in one continuous session of Congress. It is probable therefore, that the measure will be enacted into law during 1921.

The mining industry asks of Congress not preferential consideration, not special privilege, but we ask that in the building of an economic platform on which the industries of our nation are to stand for many years to come, that no gaps be left through which any worthy industry may be dropped to bankruptcy and extinction. We ask that, when the product of any mineral industry is essential to economic structure, and when our known supply of this mineral is sufficient to justify hope of adequate production through development, a sufficient measure of protection be given to these industries that they may endure, and that they may employ American workmen at American scales of wages in the development of worthy American industries, these industries which have always been the bone and sinew of our nation, the American mining industries.

All this means work, real work, but work that we can approach confidently and vigorously in view of the progress we have made.

We can gain from looking back over the long road we have come ample encouragement to finish the journey.

TAXATION PROBLEMS OF THE MINING INDUSTRY

By McK. W. Kriegh
Chief of the Tax Division, American Mining Congress

AMONG THE VITAL PROBLEMS now confronting the mining industry, that of taxation has reached proportions of most serious magnitude. Numerous varying, unscientific, and inequitable methods of federal, state, county and municipal taxation have produced a tax burden that is unnecessarily oppressive and difficult to sustain, especially since the inception of the present period of acute industrial depression; and to the average taxpayer the involved system of procedure in the determination, assessment, adjustment, and collection of local, state and federal capital stock, property, franchise, excise, transportation, income, profits, and miscellaneous taxes is highly technical and extremely complicated.

Some of the questions to be considered at the Mining Congress tax conference during the convention are: (1) methods for securing prompt determination of federal tax liability; (2) early settlement of cases pending from the war-time period; (3) lack of uniformity and co-ordination in the application of local, state and federal tax laws; (4) effect of the continued issuance of tax-exempt securities; and (5) new federal revenue legislation.

McK. W. KRIEGH

Determination of Tax Liability

Administrative changes in the organization and methods of the Revenue Bureau which will secure prompt determination of tax liability are vitally necessary. The annual reports of the Commissioner of Internal Revenue for 1919 and 1920 emphasize this need, and favor the decentralization of the income tax unit by transfer of the audit of returns to collectors' offices, and the adoption of measures leading to the extension of authority and discretion to field officers in order that disputed items and apparent errors and omissions may be adjusted while there is convenient opportunity for necessary conferences with taxpayers. In this connection the plan of having a board of appeals in every state to pass upon controverted questions has been suggested as one means for avoiding long delays in the final adjustment of such questions and litigation before the department and the courts. It seems highly desirable for the government to bring justice to the taxpayers rather than to compel them to seek justice at great inconvenience and expense; and to give to them an opportunity to adjust their tax liability in their respective districts without being required to appear before the Bureau at Washington.

Clarification of Procedure

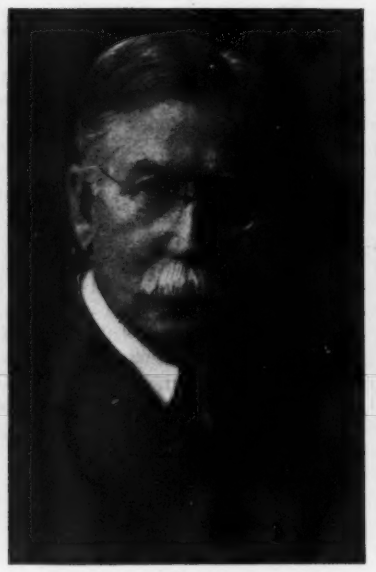
Present procedure in the assessment and collection of income and profits taxes and in the prosecution of claims could be clarified and made less onerous to the taxpayers if the necessity for employing expert counsel and for traveling long distances in order to secure a proper adjustment of these matters could be removed by the further decentralization of audits and the establishment of district or state boards of review and appeals. Audits of returns by the government are now duplicated in many instances due to the system of preliminary audits in the collectors' offices, audits by the field division which has its headquarters in Washington, and audits by the various unit audit sections both before and after field audits have been made. The necessity for these various audits and re-audits may be apparent to the administrative heads of the Revenue Bureau, but the continued congestion which has existed in the organization during the past three years without noticeable diminution seems to justify the criticism of the system. The fact that so many important questions are still undetermined, thus compelling taxpayers to accept arbitrary settlements or to resort to the Federal courts for relief, has caused much of the general complaint against present methods.

Simplification of Forms

Present forms for making income and profits returns are generally acceptable to the accounting profession, but are too complicated to be easily understood and correctly executed by the average taxpayer. Even skilled bookkeepers and auditors with many years of experience have found their preparation difficult and confusing. Out of this situation thousands of disputes have developed due to the erroneous classifications or computations of items and schedules of the returns. An analysis of the form for individuals whose net incomes are in excess of $5,000 reveals the fact that deductible interest on indebtedness is called for in three separate schedules; taxes appear as a deductible item in three schedules; bad debts are included in two different schedules; expenses and repairs are classified and reported in four distinct schedules; depreciation and property losses are listed in four schedules; and income is divided into nine schedules for kinds of income and three schedules for totals. The allocation of income, expenditures, and losses to these various schedules is for the purpose of obtaining a proper classification of income and an appropriate distribution of expenses and losses in order to accurately analyze business operations; but simplicity of method promotes accuracy, while intricate and involved methods increase the possibility of error, and therefore a simpler form of return would meet with general satisfaction. A form containing two main schedules, namely, for gross income and allowable deductions, from which net income could be determined, with supplementary schedules showing such analyses of the items of the main schedule as might be required for purposes of verification, has been suggested. The Revenue Bureau, however, contends that the present forms compel taxpayers to supply necessary information which would be omitted if the forms were changed, and for that reason this plan has not met with approval.

It has been evident to those who have had constant dealing with the Revenue Bureau that the large number

A. SCOTT THOMPSON



E. L. DOHENY

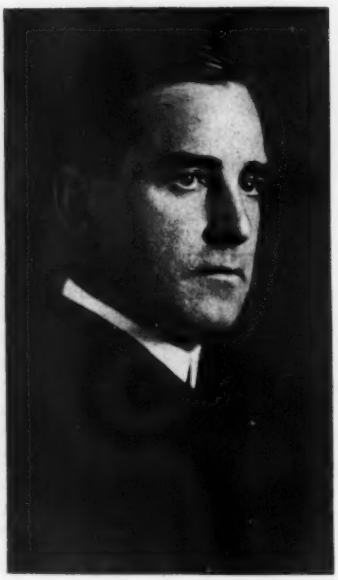
JOHN C. HOWARD

Members of the Committee on Mine Taxation

of resignations of experienced officials, due to the attractions of private employment and their replacement by untrained and inexperienced clerks, has contributed to the difficulties encountered in carrying out the provisions of the law. Appropriations for the revenue service should be sufficient to permit the establishment of a salary scale high enough to encourage the highest type of efficiency, create a desire for advancement, and foster contentment in the service; political affiliations should have no influence upon promotions; and the policy of Congress should be liberal enough to provide adequately for the employment of competent officials and any needed expansion of the revenue organization.

Prompt Settlement of War-time Cases

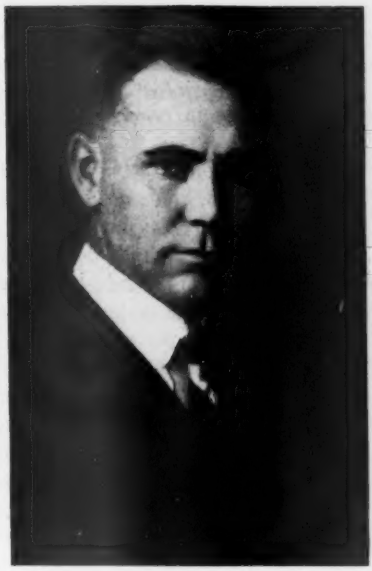
A Federal Tax Settlement Board was recommended by the 1920 convention of the American Mining Congress, and since that time has been suggested by other organizations on numerous occasions to members of the House Ways and Means Committee and the Senate Finance Committee as the best plan for facilitating the settlement of tax cases pending from the war-time period; but it is believed that the program of economy adopted by the present Congress has prevented the consideration of such a plan, there being a general feeling of aversion in Congress to the creation of any new board or commission, although it is conceded that some definite action must be taken immediately to secure the prompt adjudication of these delinquent adjustments if the industry of the country is to reach a normal status. It is safe to assume that a competent, non-partisan, independent board could be more satisfactorily dealt with than any agency or authority whose creation or appointment is influenced by policies of political expediency.



PAUL ARMITAGE
Chairman of the Committee on Mine Taxation, American Mining Congress

State and Local Taxes

Under existing laws there is a lack of uniformity in the methods of agencies of the federal, state, county, and city governments charged with the determination, assessment, and collection of the various taxes, and new measures frequently are adopted by state and local authorities who fail to give careful consideration to the relation which the tax burden imposed by them bears to the federal tax burden, with the result that in many instances the system, as a whole, becomes confiscatory. The mining industry, as well as any other industry, should contribute its just proportion of revenue to the maintenance of the commonwealth; but it should not be compelled to pay more than its pro rata share of either county, state, or federal taxes, and the relation between these different taxes should be adjusted in such a manner that the whole will spread equitably over every unit of the industry irrespective of its location. However this, relation has not been established, and varying rules and methods have been adopted in different sections of the country, under which mines of the same class, operating under similar circumstances and conditions, in many cases are inequitably grouped, unscientifically valued, and unequally taxed.



R. C. ALLEN

GEO. E. HOLMES

A. P. RAMSTEDT

Of The American Mining Congress

Tax Exempt Securities

Resolutions are now pending in Congress providing for a constitutional amendment which will grant Congress the power to tax future issues of state and municipal bonds, which are now exempt from taxation. The vast sums of capital which have been and are being withdrawn from normal business channels and diverted into non-productive and wasteful civic and state enterprises have contributed largely to the industrial depression and consequent labor unrest. Capital for industrial development and expansion has been scarce because of the demand for tax-free bonds, and thus the growth of many vital industries has been seriously retarded. Taxes will remain far in excess of pre-war rates for years to come, although income and profits of the mining industry, and business generally, are and will remain below the pre-war level. The exemption of any individual or class from the obligation of contributing to the support of the government in full proportion is indefensible. The great volume of outstanding tax-free securities, the abnormal demand therefor since the war, and the continued issuance of such securities undoubtedly adds to the burdens of the taxpaying public and deprives productive business of much needed capital for replacement and enlargement to keep pace with the rapidly increasing supply of labor. In view of this situation Congress should act without delay upon whatever measure is necessary to prevent the abnormal flow of capital into non-productive channels and the creation of a class of citizens who share the privilege of citizenship but who do not share the burden of taxation.

Columbus, Ohio, State Journal.

BOBBING IT

The Revenue Act of 1921

Of particular importance to the mining industry is the new revenue act. Repeal of the excess profits tax, rates of surtax above 32 percent and the transportation tax, will have a beneficial effect upon the whole country. A number of the provisions of the new act require study and analysis in order to determine what their effect will be upon industry. One of the most important changes is the amendment to section 204 of the act of 1918 which permits a taxpayer who suffers a net loss in any year to credit such net loss against net profit of the next succeeding taxable year. This privilege is restricted, however, by the definition "net loss" which excludes from allowable deductions, among other items, "(5) so much of the depletion deduction allowed with respect to any mine, oil, or gas well, as is based upon discovery value in lieu of cost," in other words, any taxpayer who has a net loss is denied the full deduction for depletion to which he would be entitled in the case of a net profit, and his net loss is limited to loss from business operations. This provision does not deprive the mining industry of any

right enjoyed under previous laws, but merely restricts the application of an additional privilege granted by the new act. Other provisions which are of more or less importance are those relating to foreign traders and foreign trade corporations, which, under certain conditions, are taxed substantially as non-residents—only upon incomes derived from sources within the United States; those which change the basis for determining gain or loss in the case of the sale of gifts and other property, and exchange of property; those which relate to capital gain and capital loss; those which make personal service corporations subject to the corporation income and profits taxes; those which amplify the administrative sections by giving the Commissioner of Internal Revenue authority to sign an agreement with the taxpayer fixing final tax liability, by relieving the taxpayer from the annoyance of unnecessary examinations and investigations, and by the creation of a tax simplification board to simplify forms and procedure; and those which are designed to prevent the evasion of the surtax upon stockholders of a corporation.

The Mining Congress Tax Conference

These and many other important questions will be discussed at the Tax Conference to be held during the convention of the American Mining Congress at Chicago. The problems of taxation are growing in importance, as the tax burden will be heavy for many years to come, and the refinement of methods of taxation, of administration of tax laws, and of procedure in the determination of tax liability, which will equalize, simplify, and lessen the burden, is an accomplishment which should be reached without delay.

BUREAU OF MINES FUTURE STUDIES OUTLINED BY FALL

RESPONDING to a request made by Herbert D. Brown, chief of the U. S. Bureau of Efficiency, for a report of the new activities being undertaken by the Bureau of Mines, as well as other divisions of the Interior Department, Secretary Fall has outlined the problems with which the Bureau will concern itself in the immediate future.

An investigation will be made of the relative tendency of various bituminous coals to fire spontaneously, with particular attention to the influence of different coal constituents. It is hoped to thus determine the chief causes of spontaneous ignition of these coals and to discover precautions to be taken in their storage. It is probable that the experiments, begun on August 8, will continue for ten months.

An effort will also be made by the Bureau's experts at the Pittsburgh station to find methods for the utilization of cannel coal of the Freeport seam through a study of the gas, oil and other by-products from the bone and other constituents of this coal bed.

A physio-chemical study of sulphur in coke, begun in March, will soon be concluded. Its object is to determine how sulphur occurs in coke, whether as compounds, absorbed sulphur, solid solution, etc. Absolutely nothing was known prior to this investigation about the form in which this element occurs in coke.

The work on corrosion of metals in mine water, opened during August, will continue for ten months, having for its purpose the investigation of the corrosive action of acid mine-water from coal mines on various metals.

Investigation of surface equipment for oil-well pumping, opened in the field, with headquarters at San Francisco, in June, will not be completed until the middle of 1922. The purpose of this work is to summarize and give a comparison of the methods, machinery and equipment used for the pumping of oil wells in the oil fields of the United States.

New work has been undertaken in investigations of the relation of sulphur, unsaturated hydrocarbons and other possible gum-forming constituents in crude light oil to its suitability for motor oil.

The development of dust respirators is to be undertaken at the Bureau's Pittsburgh station, the purpose of this investigation being to determine the efficiency of existing commercial respirators on which no definite data exists and to develop a respirator suitable for all industrial uses. The investigation will extend through a period of six months.

The Pittsburgh station will undertake an investigation to obtain an accurate laboratory method for the determination of ozone and oxides of nitrogen in the presence of impurities and also a field method for the determination of concentration of ozone in houses where ozonators are used. The station will also seek to obtain a method for determining the quantity and composition of dissolved gases in boiler feed-water and a gas analysis method for analyzing these small quantities of gas.

AUGUST BITUMINOUS COAL PRODUCTION SHOWS MARKED DECREASE

IF the production record of the first eight months of 1921 is not improved upon during the last four, the total output of bituminous coal this year will be less than 400,000,000 tons. The last year of such a small production was in 1909. At the end of August production for the year was six million tons behind that of 1915, sixteen million behind 1914, thirty-eight million behind 1919, forty-six million behind 1913, sixty-six million behind 1916, ninety-one million behind 1920, 106,000,000 behind 1917 and 131,000,000 behind 1918.

Production for August and for the eight months ending August 31, for the last nine years, is shown below:

August Bituminous Production, 1913-1921

Year	August production (net tons)	Cumulative production to August 31 (net tons)
1913	41,590,000	307,000,000
1914	37,751,000	277,000,000
1915	38,161,000	267,000,000
1916	42,696,000	327,000,000
1917	47,372,000	367,000,000
1918	551,14,000	392,000,000
1919	42,883,000	299,000,000
1920	48,910,000	352,000,000
Average 1913-1920	44,310,000	323,000,000
1921	34,538,000	261,000,000

Anthracite.—Shipments of anthracite during August amounted to 5,575,115 gross tons, as compared with 5,462,760 in July and 6,207,653 in June. The Anthracite Bureau of Information attributes the decrease to continued light demand for all sizes except stove and to a continuance of scattered colliery suspensions caused by market conditions and petty strikes.

FOREIGN EXCHANGE STABILIZATION.

By H. N. Lawrie
Economist, American Mining Congress

THE HONORABLE D. R. Crissinger, Comptroller of the Currency, in an address before the New York State Bankers' Association in June, called attention to the need for the stabilization of exchange. In the course of the address he made the following statements which emphasize the necessity for developing a constructive solution of the important problem:

"This has seemed an appropriate time and place to speak of international exchange in its relation to foreign trade. I venture that it never was so important as now, and that the wise and practical solution of its problems would represent one of the longest steps toward the security of human society.

"In a time when international exchange is so vital not only to our foreign trade and to the people throughout the world who have need for our products, we must take the broadest view of the relations among money systems.

"There is not that freedom of commercial interchanges which in normal times is the great equalizer and leveler. The situation demands attention lest the gold standard be gravely impaired; and so I come to bespeak your earnest consideration for the problem. I want you to be sure that in every wise effort to deal with it you will have the fullest support that the national fiscal authorities can give.

"Just when imaginative souls were rushing two generations ago to California and Australia to dig gold, Thomas de Quincey published an essay on California, which solemnly warned that if they kept on digging gold, it would presently become degraded in value, useless as a monetary standard, and uninteresting even as an enhancement of milady's charms. De Quincey foresaw the breakdown of the gold standard, pointing out that continued production of gold at the rate then attained could only bring cataclysm. Yet his fancy never approximated the huge production that was actually attained a few decades later when Africa, America, Australia and all the rest were turning out gold in their full flood. He was sure that gold would be debased and demonetised by the first rivulets; yet in fact a deluge was absorbed with no more effect than to establish gold as a well-nigh universal standard.

"Prophecy is a dangerous business. The wisdom of one generation is apt to fall hard afoul the experience of the next. We may well avoid predicting consequences from the unprecedented conditions we see about the world today, but we will be warranted in studying the experience of other times, for whatever illumination it may shed upon the problems of today and tomorrow. We will be well advised if we go slowly about scrapping old standards and systems, but on the other hand we will be wise to consider wherein we might well modify, adapt, and modernize, the mechanism of credit and exchange."

H. N. LAWRIE

Since the Comptroller of the Currency called attention to this subject, Congressman Louis T. McFadden of Pennsylvania, Chairman of the Banking and Currency Committee, introduced H. R. 8404, on August 24, requesting the President to invite the United Kingdom of Great Britain and Ireland and the Republic of France to participate in a conference with the United States. The bill authorizes the President to appoint three representatives of this government to conduct a joint investigation of the problem of exchange with three representatives to be appointed by each of the other nations invited. The conference is to convene in the District of Columbia, not later than three months after the issuance of the invitations by the President. The three representatives of this government are directed to report the results of the investigation and the recommendations of the conference to the Congress for action. And it is further authorized that these recommendations be reported for the individual action of the United Kingdom of Great Britain and Ireland and the French Republic, and such other nations as the conference may designate. An appropriation of $100,000 is to be made available for the compensation of the representatives of the United States, all reasonable expenses, and the proportionate share of this government of the general expenses of the conference, all subject to the approval of the Secretary of the Treasury.

In commenting upon this bill, Congressman McFadden stated that the rapid and extensive fluctuations of the exchanges of most of the world have exercised a most deterrent influence on the exchange of commodtiies and world trade, a condition which is a decided handicap to the financial recovery of all nations.

It is not the intention of this bill that disparities of exchange shall be investigated, but that some means should be found, and recommendations made, which would eliminate the hourly fluctuations which give rise to speculations in the exchanges beyond the requirements of actual trade transactions based upon the transfer of goods and credit. A periodic stabilization of the exchanges should remove, to a large extent, any incentive or necessity for speculation, and it is the opinion of Mr. McFadden that a system of stabilization with a longer periodic change, based upon the ability of nations to increase their gold reserves, reduce their outstanding currency issues, and bring their budgets into balance, would provide a still further incentive for the more rapid return to a normal financial condition, upon which depends resumption of normal trade throughout the world.

Proposals of all nations will be considered by the conference. It is recognized in limiting the conference to the three nations specified that their exchange transactions, in the aggregate, constitute the major volume of all exchange transactions, and that these nations naturally would recommend only such means for stabilizing exchange as would be beneficial, and would meet with the approval of all other countries of the world. On the other hand, the limitation imposed upon the size of the conference should expedite a harmonious solution of this problem and remove a condition of chaos from the economic and financial horizon of the world. As all recommendations formulated by the conference of the nations involved,

there are, Mr. McFadden believes, no binding restrictions to hamper a free and open discussion of this subject upon which the economic freedom of the world so greatly depends.

One of the most hopeful indications that the enactment of this bill will meet with approval is to be found in the attitude of our international bankers as reported in the *Wall Street Journal* two days after the introduction of the bill, as follows:

"There has been considerable discussion recently regarding the proposed conference to be held in Washington, for the purpose of stabilizing the foreign exchanges. A bill has been introduced in Congress authorizing the President to call such a conference.

"Consensus among bankers is that this meeting may be a definite step in the right direction and can, if properly conducted, go a long way toward finding a solution to the exchange difficulties. Bankers unanimously agree that the conference should be attended by the leading international bankers, economists and level-headed business men and not by politicians.

"'Confidence and absolute co-operation on the part of all countries participating is needed,' says one banker. 'Confidence in the ability of our debtors to pay not only the existing debts, but also any further credits that might be extended, is needed,' he said. 'Confidence at the time of making a contract, that exchange will not have depreciated 10% by the time payment is made, is of vital importance to the revival of trade. If trade can be returned to normal, there is no doubt, although the process may be a long drawn out one, that the exchanges with the possible exception of Central Europeans, can be restored to parity.'

"'In a word,' said the vice president of a large bank, 'the situation can be cleared up if every country earnestly co-operates. Each country must do all in its power to balance its budget by a strict policy of national economy and taxation, by eliminating all unnecessary expenses and by reducing all necessary expenses to a minimum and finally by arresting the issue of paper currency."

Another most hopeful sign for this movement is to be found in the attitude of the *London Times*, which complains, with reason, that abnormal taxation is swallowing the investment reserve of the individual, admitting also the grievous results produced by the fluctuating values of the pound sterling, and the mark, and lays down the fiat that sooner or later international traders must come to some agreement which will stabilize exchanges.

In commenting upon this reference, the *Washington Post* made the following editorial comment:

"Until in that way or by some other approved method the exchange question is satisfactorily settled, it is hopeless to look for a resumption of international commerce on the magnificent scale or which under present world conditions a steady money market would be certain to insure. It would seem therefore to be a prime duty of statesmen everywhere to devote their earnest attention to the solving of this most practical and yet most baffling problem of modern times."

The mining industry generally is dependent upon the export trade in order to sustain full-time operation. It is not necessary, therefore, to emphasize the importance of arriving at a proper solution of a problem which seriously affects copper producers, manufacturers of copper products, producers of coal, oil and other products dependent upon an export market.

The gold mining industry is especially interested in the solution of this problem, for the reason that the entire life of the industry is dependent upon the maintenance of the gold standard. Should the gold standard be abandoned, it is apparent that gold would be reduced wholly to an industrial commodity basis, the demand for which does not normally exceed one-fourth of the world's production. It may be assumed, however, that the leading nations of the world in control of the monetary gold stock will exercise a strong influence in removing this chaotic condition in exchange which constitutes a menace to the maintenance of the gold standard.

In view of the fact that a conference may be called to investigate the possibilities of stabilization, it would indeed be premature to outline any specific proposal. On the other hand, it is essential that certain general observations should be made relative to the nature of the problem. In analyzing the present chaotic state of foreign currencies and the possibilities of stabilization, the following items should be emphasized:

1. Exchange experts are of the opinion that from 50 to 75% of the total volume of all exchange transactions have no relation to the actual movement of commodities, or, in other words, are purely speculative.
2. These experts are also of the opinion that the most depreciated currencies are those largely dealt in by speculators because of the opportunity for more profitable return.
3. The speculative transactions in foreign exchange unquestionably have a marked tendency to accentuate the variations in exchange.
4. There also seems to be no question that this speculative attack on the currency of a nation may more than offset any domestic improvement that might occur in its financial condition.
5. It may be reasonably construed from the foregoing that speculation in exchange also has a marked tendency to undermine the financial morale of nations, particularly those whose exchanges are most depreciated, and to a large degree removes the incentive for the improvement of the domestic financial position of such countries.
6. These momentary and violent fluctuations in exchange constitute a risk which must be covered by an additional item in price, penalizing our export trade in competition with other nations.
7. Speculation in exchange is even more far reaching in its influence and importance than speculation in the sale of a commodity, for exchange is the unit of measure of all commodities, and the international exchange of all commodities is governed by the stability of national currencies and their relation to the gold standard.

The problem before the Exchange Conference would seem to be the elimination of speculation in exchange. Any proposed remedy should also reflect in the exchange rate the improvement or the weakness of the domestic financial position of a nation. It should reflect ability to increase gold reserves, decrease note circulation, balance fiscal budgets, decrease adverse trade balances, and all other sound improvements in financial conditions.

In view of the imperative need of determining a constructive solution of this problem, it may be anticipated that an early hearing will be held before the Banking and Currency Committee, to which H. R. 8404 has been submitted, in order to expedite the enactment of the bill and the convening of the conference. This is a subject so vital to the interests of the mining industry that it should be fully discussed at the forthcoming convention of the American Mining Congress with a view to consolidating the support of the mining industry in its favor.

SENATORS ASK MELLON TO ACT IN BEHALF OF GOLD MINING

THE McFADDEN GOLD BILL, H. R. 5025, was referred to in Senate debate September 23. Senator Ashurst, Democrat, of Arizona, asked Senator Oddie, Republican, of Nevada, whether or not he had received any response to a letter he wrote the Secretary of the Treasury Aug. 17 last, transmitting a communication relating to the gold mining situation. Senator Oddie replied that he had not yet received an answer. The letter and communication are as follows:

August 17, 1921.

MY DEAR MR. SECRETARY:

The following Senators have signed the enclosed resolution relating to the existing crisis in the gold mining industry of the nation and the importance of maintaining the gold standard of the world:

Tasker L. Oddie (Nevada)	Wm. E. Borah (Idaho)
H. O. Bursum (New Mexico)	T. J. Walsh (Montana)
Chas L. McNary (Oregon)	Andrieus A. Jones (New Mex.)
Lawrence C. Phipps (Colorado)	Henry F. Ashurst (Arizona)
Ralph H. Cameron (Arizona)	Key Pittman (Nevada)
Samuel D. Nicholson (Colorado)	John B. Kendrick (Wyoming)
Thomas Sterling (South Dakota)	Robt. N. Stanfield (Oregon)
Samuel M. Shortridge (Cal.)	W. L. Jones (Washington)
F. R. Gooding (Idaho)	Peter Norbeck (South Dakota)
Hiram W. Johnson (California)	Miles Poindexter (Washington)
H. L. Myers (Montana)	E. F. Ladd (North Dakota)

We will appreciate your considerate and early attention to the subject matter of the resolution and a detailed and complete reply to the questions therein presented.

Very truly yours,

(Signed) TASKER L. ODDIE.

HON. ANDREW W. MELLON,
Secretary of the Treasury
Washington, D. C.

RESOLUTION ON THE GOLD SITUATION

TO BE SUBMITTED TO

THE HONORABLE ANDREW W. MELLON,

SECRETARY OF THE TREASURY

BY

MEMBERS OF THE UNITED STATES SENATE

Whereas, Gold is the standard of value and the basis of all credit, and its production is vitally important to the financial and commercial life of the nation and of the world; and

Whereas, The production of gold in the United States has declined from $101,035,000 in 1915 to $49,509,000 in 1920, a decline in excess of 50 per cent, due to the fact that the price of gold is fixed by the government, while the cost of producing gold has greatly increased; and

Whereas, The consumption of gold in manufactures and the arts increased from $37,820,000 in 1915 to $75,490,000 in 1919, an increase of 100 per cent, due to the excessive demand for luxuries and the fact that the government has been supplying the industrial consumers of gold with the metal at the pre-war price; and

Whereas, The normal process of deflation will not be sufficiently rapid to prevent the further decline in the production of gold and the wastage of developed gold ore resources due to the flooding of the mines; and

Whereas, The gold standard cannot be permanently maintained without gold production, and the nation is confronted today by the prospect of a heavy drain upon the monetary gold reserve which will necessitate a still further curtailment of credit; and

Whereas, Representative Louis T. McFadden, Chairman of the Banking and Currency Committee, has introduced a bill, H. R. 5025, in the Sixty-seventh Congress which provides for the maintenance of the normal gold production of the United States by an equitable adjustment between the producer and the industrial consumer of gold; and

Whereas, H. R. 5025, containing a provision to levy an excise, in accordance with the Constituion has been introduced in the House of Representatives and referred to the Ways and Means Committee thereof; and

Whereas, H. R. 5025 involving both the policy and administration of the Treasury Department has been referred by Chairman Fordney to the Secretary of the Treasury for an opinion; now, therefore, be it

RESOLVED, That the undersigned, members of the United States Senate, urge upon the Secretary of the Treasury the significance of his reply to Chairman Fordney in determining the status of the gold mining industry, which is vitally important to the maintenance of the gold standard and the financial security of the nation; and be it further

RESOLVED, That if upon the analysis of the Secretary of the Treasury reasons cannot be definitely assigned for opposing the provisions of H. R. 5025, the Secretary is requested to endorse the same in order to expedite the action of the House and permit the bill to be considered by the Senate; and be it further

RESOLVED, That if the Secretary of the Treasury has specific reasons for opposing the provisions of H. R. 5025, he is hereby urgently requested to formulate a proposal for enactment by Congress: first, to protect the gold mining industry from destruction, which is a serious matter irrespective of the fact that its operation is necessary as the basis of our monetary system; and second, in anticipation of the heavy foreign drain upon our gold reserve, to provide for augmenting said reserve from sources of domestic production and thereby lessen the need for the further and extensive curtailment of credit which otherwise would result.

GREAT STRIDES YET TO BE MADE IN MINE SAFETY AND FIRST AID

CONTINUED SUPPORT of the federal government in all mine safety work was pledged by Congressman Marion E. Rhodes, chairman of the House Committee on Mines and Mining, at the International Mine Rescue and First Aid Meet held at St. Louis, September 1-3.

"Splendid as has been the work of the Bureau of Mines in the conduct of its work and the justification for its organization which is found in the results achieved, it has not, by any means, completed its work," Mr. Rhodes said. "It has, in fact, only made a start. Every effort must be made by all concerned to achieve the condition of perfect safety. All organizations, federal, state and individual, must co-operate to this end. There is no stronger plea which reaches the ears of Congress than that which carries with it the saving of life, and you may be assured that the federal government will do its just share of this work."

First award in the combined mine recuse and first aid contest went to the Independent Coal and Coke Company team, of Salt Lake City. Second award went to the Benton District team, Benton, Ill., and third place to the Owl Creek Coal Company team, Gebo, Wyoming.

The team representing the New River Company, McDonald, W. Va., ranked first in the mine rescue contest; that of the H. C. Frick Coke Company, Leisenring, Penn., second and the Benton District team, third.

Championship honors in the first aid contest went to the United States Fuel Company. This honor called also for the Rocky Mountain First Aid cup.

Following were the winners in the first aid contests between teams from the different states:

ALABAMA, Team No. 18, Woodward Iron Co., Dolomite.
ARKANSAS, Team No. 50, Central Coal & Coke Company, Huntington.
COLORADO, Team No. 60, Colorado Fuel & Iron Company, Pueblo.
ILLINOIS, Team No. 19, United States Fuel Company, Westville.
INDIANA, Team No. 43, J. K. Dering Coal Company, Clinton.
IOWA, Team No. 52, U. M. W. of A., District 13, and Iowa Coal Operators' Association, Buxton.
KANSAS, Team No. 44, Western Coal & Mining Company, Pittsburg.
KENTUCKY, Team No. 9, Consolidation Coal Company, Jenkins.
MISSOURI, Team No. 51, Pierce-Hess Coal Company, Bevier.
NEW MEXICO, Team No. 30, St. Louis, Rocky Mountain & Pacific Coal Co., Raton.
OKLAHOMA, Team No. 63, Rock Island Coal Mining Company, Alderson.
PENNSYLVANIA, Team No. 59, Bertha Coal Company, Pittsburgh.
UTAH, Team No. 24, Independent Coal & Coke Co., Salt Lake City.
VIRGINIA, Team No. 55, Clinchfield Coal Corporation, Wilder.
WEST VIRGINIA, No. 48, Davis Coal & Coke Company, Thomas.
WYOMING, Team No. 15, Owl Creek Coal Company, Gebo.
DOMINION OF CANADA, Team No. 47, Western Fuel Company of Canada, Ltd., Nanaimo, B. C.

The mine rescue state championships were awarded as follows:

ILLINOIS, Team No. 1, Benton District Team, Benton.
INDIANA, Team No. 6, Knox County Operators' Association, Bicknell.
PENNSYLVANIA, Team No. 3, H. C. Frick Coke Company, Leisenring.
UTAH, Team No. 15, Independent Coal & Coke Company, Salt Lake City.
WEST VIRGINIA, Team No. 2, The New River Company, McDonald.
WYOMING, Team No. 4, Owl Creek Coal Company, Gebo.

At the meeting of the Joseph A. Holmes Safety Association, one of the features of the international gathering, the annual award of medals for deeds of bravery took place. Six men from Butte, Mont., were awarded medals for bravery in attempted life saving at the Leonard mine of the Anaconda Copper Mining Company They were K. P. Krueger, Lew E. Ryan, Frank Pierce, Herbert Farlin, George Reichert and John Gregovich. Alex Ogilvie and Thomas Gold, of Lehigh, Oklahoma, were awarded medals for saving a workman who came in contact with electric wires. Announcement was made of the award of medals to the nearest living relatives of Francis Henry Murphy and William Ferrington, of Franklin, Kansas, and Lasco Robinson and Clarence Williams, of Degnan, Oklahoma, who lost their lives in attempting to save stricken comrades.

In the course of an address on "Joseph A. Holmes and Safety In Mining," G. W. Traer, of Chicago, paid the following tribute to Dr. Holmes:

"The strength and nobility of Dr. Holmes' character and the usefulness of his life are indelibly recorded in the annals of the American Mining Industry.

"We sometimes say of a man that his soul is in his work when there is no soul in the work and the expression is a mere figure of speech describing intense application perhaps to a selfish purpose. In Dr. Holmes' case the expression is no figure of speech, but a true description of the humane feeling that inspired his persistent laborious efforts to lessen the toll of death and wounds in the mining industry and the want and misery that follows.

"Throughout his life his work bore more profit to others than to himself. His work as an educator, as a practical geologist and in research, investigation and experiment, all was forward looking and of great productive value to the nation. Probably no man ever was associated with him without receiving some benefit or without preserving some memory that gives a higher meaning to life than mere material gain. He was not the first to conceive a practical sentiment for greater care in protecting workingmen from death and injury, any more than Abraham Lincoln was the first to conceive the sentiment that human slavery was a malignant social disease, under which civilization could not permanently exist. But Dr. Holmes developed it greatly as a public sentiment and his diligence and zeal first gave workable force and direction to it in that form. With him as the apostle and leader the work was carried on until today your great organization stands as his monument; not a monument in insensate stone, but one that lives and expands and is a practical exponent of a great humane ideal."

PETROLEUM STATISTICS FOR JULY

PRODUCTION of lubricating oils was greater in July than in June, but that of gasoline, kerosene, and gas and fuel oil was smaller, according to the Bureau of Mines summary prepared by H. F. Mason, petroleum technologist.

The daily average kerosene production was 4,474,972 gallons, a decrease of 246,264 gallons from June. Stocks at the end of the month showed a decrease of 22,855,039 gallons.

Daily average gas and fuel oil output was 1,500,000 gallons smaller than in June. That of lubricating oils was 22,635 gallons larger (daily average) than in June. Gasoline production and consumption is shown below:

Gasoline, July, 1921

	Gallons
Stocks July 1	750,644,450
Production	419,641,815
Imports	1,127,704
Total	1,171,413,969
Exports	27,382,708
Shipments to insular possessions	2,036,398
Domestic consumption	457,758,078
Stocks end of month	684,236,695
Total	1,171,413,969

WITH THE CHAPTERS OF THE AMERICAN MINING CONGRESS

CALIFORNIA CHAPTER WATCHES CLOSELY AFTER LEGISLATIVE MATTERS

By Robert I. Kerr, Secretary

THERE has been no material gain in the membership of California Metal and Mineral Producers Association during the past year, due in a great measure to the unsatisfactory conditions which have confronted all branches of the industry. The curtailment in gold mining and the suspension of operations in practically all of the copper mining companies of the Association have materially reduced its income.

The first real work that confronted the board of directors during the year was the consideration of a batch of bills introduced at the forty-fourth session of the California legislature which convened January 3, 1921.

Proposed amendments to the Workmen's Compensation, Insurance and Safety Act, introduced at the suggestion of the Industrial Accident Commission, which would have increased the cost of compensation insurance over 40 percent, were defeated.

Legislation proposed by the radical element providing for the elimination of the waiting period, increased weekly benefits, the universal eight-hour work day and Sunday closing were also defeated.

A revision of certain mine safety rules relative to the use of mine rescue apparatus was accomplished upon hearings held before the Industrial Accident Commission.

Labor conditions have improved during the year. All companies report a surplus of men and a material increase in efficiency.

War-time wages have been slightly reduced in every section of the state, and aside from a strike which occurred as a result of such action in the Grass Valley district, employes have generally accepted such reductions without complaint.

An effort on the part of the large power companies of the state to further increase rates for electric energy has been defeated. Two of the largest companies have applications now pending before the railroad commission for an order fixing just and reasonable rates. Inventories and appraisement values will be submitted by the utilities in support of the applications and it will be sometime before the matter reaches a final hearing.

Very efficient service has been rendered the Association by the American Mining Congress, the parent organization, at Washington, during the year. The bulletin service covering proposed tariff legislation and discussions and proposed amendments to the income tax law have been of valuable interest to the membership, all of whom are either directly or indirectly interested therein.

The immediate response to a request for funds to be used in publicity work in behalf of the McFadden Gold Excise and Premium bill, is the best evidence of the confidence reposed in the work of the American Mining Congress, by Californians directly interested in the proposed legislation.

This Association was honored at Denver, Colorado, November, 1920, by the election of its vice president, Wm. J. Loring, as president of the American Mining Congress. Mr. Loring's untiring efforts in behalf of the mining industry and his reputation as an international mining engineer has made the gentleman an ideal occupant of this most important trust.

UTAH MINES KEPT IN OPERATION BY PITTMAN ACT

By A. G. Mackenzie, Secretary

WITH THE EXCEPTION of active prospecting for oil, the year 1920 has been the most unsatisfactory for the mineral industry of Utah for a generation past. It is safe to say that were it not for the Pittman Silver Act, none of the metal mines of the state would have continued operations. The coal mines have had a very unsatisfactory year on account of restricted market. All the properties have been operating on part time. Metal mines began to suspend ore production in December of last year. By April 1 of this year many of the most important metal mines of the state, including the Utah Copper Company, suspended ore production entirely. The year's production will be less than for many years past.

Prospecting and development work have been continued by the companies wherever possible in efforts to hold organizations together and to relieve unemployment. Some of the companies have employed double shifts at half-time so as to afford employment to as many men as possible.

Oil prospecting in southern and eastern Utah has been very active, with several of the larger interests of the country and a multitude of smaller interests at work in various localities. Commercial production has not resulted thus far but prospects are regarded as encouraging.

The metal outlook is more encouraging than at the close of 1920. Tariff legislation is expected to improve the lead situation. Every passing day, of course, brings nearer the time when demand for copper will again make itself felt. The Pittman Act assures a fair price for silver for several years to come and with these three metals in good shape all the other industries of Utah will prosper.

The Utah Chapter has engaged in various activities during the year. A committee of the chapter appeared before the Ways and Means committee at Washington in January in connection with the tariff on lead. Representatives of the chapter appeared at various hearings before railroad committees and the Interstate Commerce Commission in connection with rate on ore and bullion, in consequence of which the increase of August, 1920, on bullion was removed as to Utah on August 11.

A decision of the State Utilities Commission in the matter of electric power rates was rendered in March, giving the power company about 15 percent of the increases requested. This is a matter which had engaged the attention of the chapter for more than a year.

Several committees of the chapter are now at work on matters of legislation and arrangements are under way to hold a Metal Mining Institute this fall under its auspices.

NEW MEXICO CHAPTER HAS RESULTS TO SHOW FOR YEAR'S WORK.

By Burton Bunch, Secretary

EVEN though the year since the organization of the New Mexico Chapter of the American Mining Congress in Silver City on October 4, 1920, has witnessed the closing of the state's greatest mining industries and economic conditions generally have been adverse, the work the chapter has been able to do has, in the minds of the organizers, fully justified its existence. Naturally, its activities during the last few months of the year have included no outstanding accomplishments, beyond the sustaining of interest in the body to insure its continuance in spite of unfavorable conditions. A spirit of optimism as to a final favorable outcome of the trials that have beset has prevailed.

As this report is written, plans are being perfected for the holding of the chapter's first annual meeting in Silver City on October 3. Officers of the chapter have expressed a desire to keep it functioning even if depressing influences should appear to be taking a stand for many more months of combat. A new list of officers will have been announced, and a new policy determined upon, by the time this matter has been printed. It is to be regretted that these things cannot be reported at this time.

The first few months of the life of the chapter were very active, first with completion of plans of financing, and next with the necessity of participation in a gubernatorial campaign, during which one party's candidate injected the question of mine-taxation in such a way that action by the chapter was desirable. This candidate was defeated in the election in November, 1920.

Following the election, and early in the present calendar year, the chapter, and not individual mining men who had been the subjects of attacks in the campaign, was represented in the state capital during the biennial assembly of the legislature, at which session new features of a revenue code were enacted much less drastic than had been proposed and agitated. The chapter, through its committees, had without doubt been responsible for this more favorable consideration of the mining interests.

Recently, direct and personal services have been rendered to members of the state chapter by the obtaining of information from authoritative sources on various subjects, and it has been the effort of the executive staff to build up, during dull times, a feeling among members that these services were available. A close watch on legislative matters in the national capital has been kept, and matters of interest to the operators, both large and small, have been reported on. Such activity was the transmission directly to members of information concerning development of proposed laws to defer assessment work on claims, which effort was of great value to owners of such property, some of whom were not members of this organization.

The first year of the chapter's existence has seen the gathering together of much material for the files, relating to various phases of mining, which will be of great value when conditions have become more normal and incentive for use of such matter will be greater.

WELLS SEES BRIGHT FUTURE FOR COLORADO MINING

"THE MINER IS NOT DISCONSOLATE. He is accustomed to misfortunes and is able to face them with a cheerful smile," said Bulkeley Wells, former president of the American Mining Congress, in an address delivered recently before a Colorado business men's club.

"Though the situation is a bit dark just now, the future is bright, and it is the sight of this future that keeps the metal miners faithfully toiling away, in spite of the fact that his reward is meager today," Mr. Wells said.

"Just at present the greatest need of the Colorado mining industry is outside capital—huge amounts of it. And thanks to the numberless 'fake' mining schemes which have been perpetrated about the country, this outside capital is terribly hard to get.

"Today we find that lead has made a comfortable gain in price, while zinc and copper have made small gains in value recently. On the other hand, silver is losing value, in spite of the apparent guarantee of price establishment by the Pittman bill.

"Colorado's gold situation is not quite satisfactory for there are scores of localities that should be explored. Where surface ores have been exhausted there has been little or no search for the pockets hidden under the ground, which virtually always prove more valuable than the surface ores. Cripple Creek is a particularly striking example of this and there may be some profitable activity in that field.

"At present radium is our only really bright spot and, while we have this substance in large quantities, we are still faced with a rather slow market, for those persons who require radium for their work, and experimentation, often are unable to purchase an adequate supply because of a lack of funds.

"But, in spite of the present situation, I feel sure that the metal mining industry of the state will brighten up shortly, placing Colorado again in the front rank of the mining states."

ALASKAN COAL DEVELOPMENTS

BOTH mining and development work has been done at Alaska coal mines during the last year by the Navy Coal Commission and the Alaskan Engineering Commission. Two hundred tons a day have been mined at Eska for railroad use. In the Nenana lignite fields, operated under government lease, fifty tons a day has been mined for domestic use. At two small mines in the Broad Pass district, 1,000 tons have been taken from each mine.

Several buildings have been constructed by the navy commission at the Chickaloon mines, including a powerhouse, office, hospital, first aid building, a hotel and numerous employes' cottages. Prospecting had been conducted at Coal and Gravel creeks, but development has been very difficult.

AMERICAN TRADE with soviet Russia during the first six months of the current year dropped to $13,000,000. During the corresponding period of 1919 our imports from Russia amounted to $2,975,000 and our exports to $39,464,000, and last year our imports totaled $8,555,000 and our exports to Russia aggregated $23,500,000. This year we imported $692,000 in goods and sent over commodities valued at $12,600,000. The decline is significant, emphasizing at once the nonexistence of legal restrictions to trading with Russia and the inability of the Bolsheviki to muster either credit or cash for purchasing the necessities of life in the free markets of the world.

WILLIAMSON FIELD OPERATORS REFUSE TO DEAL WITH UNION

AFTER reading the message from John L. Lewis, president of the United Mine Workers of America, to President Harding, asking that he call a conference between the mine workers and the mine owners of the Mingo field, Harry Olmsted, chairman of the Labor Committee of the Operators Association of the Williamson Field, addressed a letter to President Harding in which he reiterated the refusal of the operators' association to confer with the union miners or to treat with them in any manner whatsoever.

That the men employed in the mines of this district do not want to be governed by the United Mine Workers of America, or forced to join that organization is fully proved, says Mr. Olmsted, by the fact that 4931 out of a cotal of 5300 so employed petitioned the subcommittee of the Senate Committee on Edutation and Labor, assigned to the task of investigating the facts connected with the industrial trouble here, to make no finding which would change the relations at present existing between them and their employers. There is no strike or lockout in Mingo or Pike county, declares Mr. Olmsted; who says the mines are fully manned by satisfied and contented workmen who are only asking protection and to be made free from intimidation, gunfire and murder on the part of their self-appointed guardians, the United Mine Workers of America.

"Five times within the past two years," says Mr. Olmsted, "bands of armed men have mobilized within the borders of Kanawha County, carrying rifles, shotguns and revolvers, with the avowed purpose to march through and against other counties and to control the conditions of employment in the mines of those counties. The objective point of the latest insurrection was given out as being Mingo County, but it is believed that there was another motive behind that movement as well as behind those that have preceded it—that of creating public sentiment in their favor and to intimidate the non-union coal interests into recognizing the United Mine Workers of America."

The Mine operators in this field employ non-union miners, and therefore have nothing to arbitrate with the United Mine Workers of America, and being unalterably opposed to any recognition of that organization can see no reason for being called into conference with its representatives, says Mr. Olmsted.

Mr. Olmsted's letter to President Harding read as follows:

"In considering the appeal made to you by Mr. John L. Lewis, president of the United Mine Workers of America, as reported in the newspapers Saturday morning last, we deem it proper that you should do so with the advice that the Operators Association of Williamson Field has steadily and uncompromisingly refused to deal or confer with that organization, and must continue to abstain from doing so.

"We must content ourselves in this brief communication with the statement that there is no sort of controversy between the members of this association and their employes. There happens not to be a single employe of any member of this association whom Mr. Lewis represents or for whom he is entitled to speak.

"Every mine within this coal field is fully manned and is amply prepared to produce peak tonnage, should business require, and were orders forthcoming. The production records for May and June, last passed, were record breakers in this field. The workmen in this field are, in ratio of nine to one, at the least, men who, whether from desire or intimidation or force, became members of the United Mine Workers Organization, at the outset of the strike, but later repudiated their union pledges to reclaim their jobs. Approximately five thousand of them, which number practically included every workman in the field signed petitions during June last praying the Senate Committee on Education and Labor, which committee was charged by a Senate resolution with an investigation of our labor conditions, to make no finding which would commit this field to the domination of the United Mine Workers of America. A copy of the preamble of this petition is in mail for you for your inspection and consideration.

"During the past sixteen months the name of Mingo has become a household word throughout the United States. The entire country has been looking on, an interested spectator, while Mingo County operators have blocked the game of the conspirators whose aim it was to control and submerge coal production in West Virginia. To the coal operators belonging to this association and their loyal employes is due the credit for saving the industry in this state; the people of the United States from being frozen into submission to the demands of the United Mine Workers, and the government from being subjected to the conditions through which Great Britain has just passed.

"The operators of this field do not employ private detectives to guard their property. It is true, however, that the Baldwin-Felts agency has been used in this field recently, but only for the purpose of securing advance information with respect to intended shootings, dynamitings, arson, etc., and this service has been discontinued. The charge that these men are of the lowest type and character is not true. Many of these men have been employed by the United States government through the Baldwin-Felts agency.

"We do not doubt that you are advised of the recent events within this state, wherein the officials and members of the United Mine Workers of America contrived and executed an open, armed insurrection against the officers and the laws of this state, which vicious and unlawful act properly subjects them to the charge of treason against the state. In addition to this inexcusable offense, we are prepared to show you evidence of the loss of twenty-nine human lives and the loss of hundreds of thousands of dollars of property by explosions and incendiarism, within the Williamson coal district, chargeable to the United Mine Workers of America.

"In consideration of these circumstances, which are but briefly outlined, and in further consideration of the fact that contracts with the United Mine Workers of America are futile and useless, as can be shown by dozens and hundreds of instances, this association and its various members have persistently refused to enter into any manner of negotiations with them, and feel obliged to advise you that their policy in this relation is not subject to compromise or change.

"The so-called industrial strife will cease immediately if the United Mine Workers of America are forced to discontinue their lawless actions."

LABOR HAS ITS OWN ARMED GUARDS

INCONSISTENCY, if not insincerity, is strikingly manifested by labor leaders and agitators who object to the employment of private detectives and armed guards at the mines and other industrial plants. For labor does exactly the same thing.

On September 3 President Samuel Gompers and James Lord, head of the Mining Department of the American Federation of Labor, called on President Harding. When they left the White House Mr. Gompers gave out an interview in which he attributed the blame for the war in the West Virginia coal mine region to the employment of private detectives and armed guards. Then he proceeded directly to "Labor Temple," one of Washington's palatial office buildings, which was constructed by the American Federation of Labor as national headquarters, and wherein both Mr. Gompers and Mr. Lord have offices. And at "Labor Temple" the American Federation of Labor employs its own private detective.

William H. Howlin was commissioned as a special policeman of the District of Columbia on April 24, 1917, with authority to guard "Labor Temple" and carry arms while on the premises. He was re-commissioned on May 25, 1920. He is not on the District of Columbia payroll, since he is a private detective in the employ of the American Federation of Labor. On the night of September 3, 1921, he guarded the private property of the Federation, the offices of Samuel Gompers and James Lord, and likewise such of the Federation's printed propaganda against the employment of armed guards at the mines as may have been in the building at that time.

President John L. Lewis, of the United Mine Workers of America, and the Washington attorney of the West Virginia members of the organization, each gave out interviews attributing the West Virginia troubles to the "armed guard" or "private detective" system. And the attorney wrote his interview in his office in the Munsey Building, which is guarded by armed private detectives both day and night.

Neither Mr. Gompers nor Mr. Lewis has as yet given out an interview explaining why it is all right for labor organizations and labor attorneys to use armed guards and private detectives and all wrong for mining operators and other employers of labor to do so.

THE IRON INDUSTRY IN 1920

THE FINAL REPORT of the U. S. Geological Survey on production and shipments of iron ore during 1920, made during the second week of September, showed totals within one-half of one percent of those announced in the preliminary report of last January. Co-operation between the Survey and the operators is shown to have been developed to the highest degree.

Ore was mined in the United States last year to the extent of 67,604,465 gross tons, an increase of 11 percent over that mined in 1919. The shipments from the mines in 1920 were 69,281,341 gross tons, valued at $285,006,327, which show increases of 23 percent in shipments and 44 percent in value. The average value per ton at the mines in 1920 was $4.11, as against $3.50 in 1919. The stocks of iron ore, mainly in Minnesota and Michigan, amounted to 11,378,794 gross tons, as compared with 13,097,500 tons in 1919. These figures include only ore containing less than 5 percent of manganese.

Iron ore was mined from 403 mines in 25 states in 1920, as compared with 389 mines in 24 states in 1919. A small quantity of ore from Virginia was used in the manufacture of hydrogen gas and some of the ore from Pennsylvania was used for gas purification. In all but the far western states, where the ore is used for metallurgic flux, the bulk of the ore mined was used in the manufacture of pig iron, only small quantities being used for paint. Minnesota, Michigan, and Alabama are the three large producers of iron ore. Together they produced in 1920 about 93 percent of the total for the country, and Minnesota stands preeminent in producing about 58 percent of the grand total.

Production by states is shown in the following table.

Iron ore mined in the United States in 1919 and 1920. (In gross tons)

State	1919	1920	Percent of change in 1920
Alabama	5,053,035	5,894,011	+ 17
Arizona	.....	950	.....
California	2,053	6,667	+225
Connecticut	5,384	3,700	− 31
Georgia	71,224	104,511	+ 47
Idaho	1,838	275	− 85
Maryland	357	1,104	+209
Massachusetts	9,509	6,639	− 30
Michigan	15,438,930	17,510,742	+ 13
Minnesota	36,000,626	39,453,173	+ 10
Missouri	53,856	54,994	+ 2
Montana	3,438	10,803	+214
Nevada	.....	238	.....
New Jersey	404,428	431,567	+ 7
New Mexico	225,039	274,219	+ 22
New York	871,495	920,009	+ 6
North Carolina	58,778	71,810	+ 22
Pennsylvania	627,167	734,383	+ 17
Tennessee	283,792	375,538	+ 32
Utah	44,185	36,159	− 18
Virginia	305,096	320,924	+ 5
Wisconsin	1,087,247	981,134	− 10
Wyoming	398,613	406,501	+ 2
Other States*	19,328	4,414	− 77
	60,965,418	67,604,465	+ 11

*1919: Colorado, Texas, and Washington; 1920: Colorado and Washington.

Increases ranging from 6 percent in the Chattanooga and Adirondack districts to 15 percent in the Birmingham district were recorded in 1920. The Lake Superior district, comprising all the mines in Minnesota and Michigan and those in northern Wisconsin, mined nearly 86 percent of the total ore produced in 1920 and the Birmingham district nearly 8 percent.

More ore was mined in all the ranges of the Lake Superior district in 1920 than in 1919, as shown in the table below. The smallest increase, 0.16 percent, was in the Vermilion range and the largest, 16 percent, in the Menominee. The Mesabi range produced 63 percent of the entire output of the Lake Superior district and 54 percent of the total output of the United States.

*Iron ore mined in the Lake Superior district, by ranges, in 1919 and 1920, in gross tons**

Range	1919	1920	Percentage of increase in 1920
Marquette	4,158,751	4,457,609	7
Menominee	4,863,968	5,651,542	16
Gogebic	7,368,994	8,298,206	13
Vermilion	1,051,795	1,053,518	.16
Mesabi	33,262,954	36,641,880	10
Cuyuna	1,685,677	1,757,775	4
	52,392,339	57,860,530	10

*Includes only such Wisconsin mines as are in the true Lake Superior district.

Imports and Exports of Iron Ore and Pig Iron

The imports of iron ore in 1920 were 1,273,456 gross tons, valued at $4,963,654, or $3.90 a ton, as compared with 476,461 tons, valued at $2,385,689, or $5.01 a ton in 1919. The imported ore came chiefly from Cuba, French Africa, Spain, and Sweden. The exports of iron ore in 1920 were 1,145,037 gross tons, valued at $6,198,927, or $5.41 a ton, as compared with 996,569 tons, valued at $4,308,746, or $4.32 a ton in 1919. The exports were shipped principally to Canada. The imports of pig iron in 1920 were 185,944 gross tons, valued at $12,801,834, or $68.85 a ton, as compared with 101,665 tons, valued at $6,565,106, or $64.58 a ton, in 1919. The exports of pig iron in 1920 were 216,828 gross tons, valued at $10,074,377, or $46.46 a ton, as compared with 321,261 tons, valued at $12,313,183, or $38.33 a ton in 1919. The statistics of imports and exports were compiled from the records of the Bureau of Foreign and Domestic Commerce.

The production of pig iron, excluding ferroalloys, as reported to the Geological Survey, was 36,242,748, gross tons, an increase of 19 percent as compared with 1919. The quantity of pig iron, exclusive of ferroalloys, shipped or used in 1920, according to producers' reports, amounted to 35,710,227 gross tons, valued f.o.b. at the furnaces at $1,140,904,096, an increase of 19 percent in quantity and of 47 percent in value, as compared with 1919. The average price per ton at furnaces in 1920, according to these figures was $31.95, as compared with $25.75 in 1919.

The shipments of ferroalloys of all classes in 1920, according to producers' reports and estimates by the United States Geological Survey, amounted to 612,808 gross tons, valued at $77,519,367. Comparable figures for 1919 are not available.

The production of steel in the United States in 1920, according to the American Iron and Steel Institute, was 42,132,934 gross tons, of which 32,671,895 tons was open-hearth, 8,883,087 tons was Bessemer, and the remainder, 577,952, was crucible, electric, and miscellaneous. The production in 1919 was 34,671,232 tons, consisting of 26,948,694 tons of open-hearth, 7,271,562 of Bessemer, and 450,976 tons of crucible, electric and miscellaneous.

IRON MINE ACCIDENT RATE SHOWS DECREASE

OPERATORS' REPORTS show 106 deaths, a decrease of 33, and 9.072 non-fatal injuries, a decrease of 26, from accidents in iron mines during 1920. Bureau of Mines final tabulations were announced in mid-September.

Employes in the industry numbered 45,990 and averaged 295 working days. The fatality rate was 2.34 and the injury rate 200.49 per 1,000 300-day workers.

Of the 106 fatal accidents during the year, 76 occurred underground, 10 in shafts, 6 at open-pit workings, and 14 in surface shops and yards. At mines in Minnesota 42 men were killed, 27 in Michigan, 25 in Alabama, 6 in New York, and 1 each in New Jersey, New Mexico, Virginia, and Wisconsin. As compared with 1919, all States except New Mexico, New York, and Wisconsin showed a reduction in the number of men killed. New Mexico and Wisconsin showed no change from the previous year, there being one fatal accident in each of these two States during each of the past two years. New York suffered 6 fatalities, or one more than in 1919.

Of the total of 9,072 non-fatal accidents, 6,565 occurred underground, 169 in shafts, 1,010 at open-pit mines, and 1,328 at surface shops and yards. In the number of men injured, Michigan led the list with 3,202, followed by Minnesota with 2,943, Alabama 1,539, New York 862, Wisconsin 150, New Mexico 98, New Jersey 90, Virginia 50, Tennessee 45, and Georgia 13. These figures represent decreases for Michigan, Minnesota, New Jersey, and Virginia, while they indicate increases for Alabama, New Mexico, New York, Tennessee and Wisconsin.

GRANITE QUARRYING INDUSTRY MAKES BIG GAIN

AN INCREASE of 22 percent in the number of employes and 21 percent in shifts worked during 1920 is shown in operators' reports tabulated by the U. S. Bureau of Mines. The total number of men employed was 12,735, or 2,269 more than during the twelve months preceding.

Accidents resulted in the injury of 1,392 men, or 130.53 per thousand, and the death of 22, or 2.06 per thousand 300-day workers. For 1919 the corresponding percentages were 124.70 and 1.81.

Seven of the fatal accidents occurred in California, 5 in Pennsylvania, 3 in Minnesota, 2 each in Vermont and Wisconsin, and one each in Colorado, Maryland, and New Hampshire.

MINING EXPERIENCE OF THE NATION'S LEADING STATESMEN

THE ROMANCE OF THE MINES IS woven into the lives of many of the highest officials in Washington. The President's secretary, members of the Cabinet and scores of Senators and Representatives have at different times during their careers engaged in the production, manufacture or distribution of mineral products. Some have experienced the adventures of prospecting, others have made—or lost—good money as operators, while many can recall long years spent as workmen under and above ground.

George B. Christian, secretary to the President, was engaged in the limestone business in Marion County, Ohio, in 1915, when he became secretary to Senator Harding.

Four members of the Cabinet have, or have had, either direct or indirect connection with the mining industry. Secretary of the Interior Fall has been a mine workman and is today interested in mining operations. Secretary of State Hughes was special assistant to the Attorney General, assigned to coal investigations, in 1906. Secretary of Labor Davis began working at the age of eleven and learned his trade as a puddler in the iron and steel works at Sharon, Penn. He went to work in the Pittsburgh iron mills in 1892 and next year moved to the tin plate mills at Elwood, Indiana. He joined the Amalgamated Association of Iron, Steel and Tin Workers, was elected to various offices therein, and is still a member in good standing. The mining experience of Secretary of Commerce Hoover is very generally known.

The House leader, Representative F. W. Mondell, of Wyoming, has been engaged in mining in various western states and territories. He took an active part in the development of the Cambria mines, and was assistant land office commissioner from 1897 to 1899. The chairman of the House Committee on Mines and Mining, Representative Marion E. Rhodes of Missouri, was for many years attorney for mining firms and mine employes.

Senator Harreld of Oklahoma, was a lawyer in Morgantown, Ky., less than a decade ago. But during the interim he has made more than a million dollars out of Oklahoma oil.

Senator Ralph H. Cameron of Arizona is interested in mining, having spent many years in mining districts of the west. Senator Shortridge of California was once a mine workman.

Senator L. C. Phipps of Colorado was employed in the iron mills of the Carnegie Company of Pennsylvania, and after leaving school became vice president and treasurer of the company, retiring in 1901.

Senator S. D. Nicholson of Colorado went to that state in 1881 and spent several years in the metal mines of Leadville and the coal mines of Trinidad as miner and foreman, becoming a mine manager and later a mine owner. For many years he has been engaged in the development and management of mine properties in western states. During the war he was a member of the state branch of the U. S. Fuel Administration.

Senator Frank R. Gooding of Idaho was for many years a contractor for mining companies in the Wood River country, Idaho.

Senator F. R. Kellogg of Minnesota, as special counsel for the government, prosecuted the dissolution suit against the Standard Oil Company.

Senator Tasker L. Oddie of Nevada has had interesting mine experience. In 1898 he moved from New York to Nevada in the interest of his employers, Anson Phelps Stokes and the Phelps Estate, who were heavily interested in Nevada mining, railroad, and banking enterprises. He studied the field, acquired mining prospects and himself performed manual labor upon them until they began to produce satisfactory financial returns. He met Jim Butler, who discovered the great gold and silver camp of Tonopah in 1899, and became a partner of Butler in these locations, together with Wilson Brougher. These three men, without capital, developed these properties by their own hard work into one of the greatest gold and silver camps in the west. Goldfield, another famous camp, came into being as the result of the work of these men, and their action started the revival in Nevada mining enterprises from which many million dollars have been produced. Senator Oddie was first manager of the original Tonopah properties and developed them during the first five years to a point of successful production. He has since been active in prospecting and mine development. He is a member of the American Institute of Mining and Metallurgical Engineers.

Senator A. A. Jones of New Mexico was First Assistant Secretary of the Interior from 1913 to 1916. Senator E. F. Ladd of North Dakota is a chemist and a member of the American Chemical Society. Senator Peter Norbeck of South Dakota is a well driller by occupation. Representative John I. Nolan of California is an iron molder by trade and has been an officer of the International Molders' Union for fourteen years. Representative Walter F. Lineberger of California is a civil engineer and was engaged in mining in Mexico for nine years.

Representative Henry Z. Osborne of California is also a miner. In 1898 he moved from New Orleans to the live gold mining camp of Bodie, California, where for six years he was an editor. He is a charter member of the Chamber of Mines and Oil.

Representative Oscar E. Bland of Indiana, while a member of the Indiana Senate, was author of a number of acts concerning employes and conditions in coal mines, among them being the miners washhouse law, the wide entry law, and the miners' liability law. Representative A. H. Vestal of Indiana worked in steel mills and factories to obtain further education. Representative John W. Langley of Kentucky was formerly a law clerk in the General Land Office. Representative A. A. Blakeney of Maryland is director of the Chesapeake Iron Works. Representative John P. Hill of Maryland was government counsel in the Bath Tub and American Can Co. anti-trust cases. Representative P. F. Tague of Massachusetts is a manufacturing chemist.

Representative Samuel Arentz of Nevada was a surveyor, assessor, miner and timberman in Bear Gulch and Butte, Montana, and in the Lake Superior copper country. He graduated in 1904 with a degree of B.S., in mining engineering, from the South Dakota School of Mines and in 1906 received the degree of E.M. He has been a mining engineer and superintendent of mines in Idaho, Utah, Arizona and Nevada. He has also been a consulting engineer of the Bureau of Mines on complex ore problems and a member of the American Institute of Mining and Metallurgical Engineers. He has been a mining and civil engineer and mine operator in Nevada.

Representative E. J. Hutchinson of New Jersey is treasurer and manager of the Trenton Bone Fertilizer Company. Representative A. H. Radcliffe of New Jersey is secretary of the James Radcliffe & Sons Co., a structural iron works of Paterson. Representative A. E. Olpp, of New Jersey is chemist for the Catskill Cement Company. Representative A. N. Petersen of New York is president of the Brooklyn Foundry Co. Representative O. L. Mills of New York is director of the Lackawanna Steel Co. Representative J. W. Husted of New York is president of the New England Pin Co., of Winsted, Conn. Representative John D. Clarke, of New York worked for the Oliver Mining Co. (mining department of the Carnegie Steel Co.); was assistant to the secretary of mines of the U. S. Steel Corporation from its foundation to 1906. Since then he has been secretary and treasurer of other mining companies. Representative S. W. Dempsey of New York was special assistant to the Attorney General from 1907 to 1912 in the prosecution of the Standard Oil Co. and the New York Central and Pennsylvania Railroads on charges of giving and accepting concessions on freight rates.

Representative E. D. Ricketts, Ohio, spent the early years of his life aiding his father in mining coal in New Straitsville, Ohio. Representative Jos. H. Himes of Ohio, spent several years in the steel industry, working his way up from cinder-pit man to general manager. Representative C. D. Carter, of Oklahoma has been a mining trustee.

Representative H. C. Ransley of Pennsylvania is a member of the firm of Dunlap.

Slack & Co., dealers in oils and naval stores in Philadelphia. Representative Geo. W. Edmonds of Pennsylvania is interested in the coal business. Representative A. S. Kreider of Pennsylvania is engaged in the coal business. Representative John M. Rose of Pennsylvania was employed in the mechanical department of the Cambria Iron Company. Representative A. S. Kendall of Pennsylvania was engaged in mining coal in Somerset County, Pennsylvania. Representative John M. Morin of Pennsylvania worked in the iron and steel mills in Pittsburgh. Representative G. E. Campbell of Pennsylvania has been interested in independent oil and gas operations since 1903. Delegate D. A. Sutherland of Alaska is engaged in mining.

VARIOUS PROBLEMS BEFORE MINES BUREAU

TESTS on the sulphur dioxide leaching of complex ores from the Miami district in Arizona have been completed at the Southwest station of the Bureau of Mines at Tucson. It is considered that sulphur dioxide leaching is a demonstrated success on the most refractory silicious ores in the Southwest and also on ores containing a large percentage of acid soluble gangue. The commercial application of the process appears to hinge largely upon the successful working out of the manufacture of sponge iron. Laboratory work is being done on Walker-River silicious copper ore, which has soluble lime, iron, and manganese aggregating 10 percent acid-soluble gangue. Results so far obtained are quite encouraging.

A new method has been developed at the Northwest station of the Bureau of Mines, Seattle, Wash., for the determination of metallic iron in sponge iron, which has been found to be more accurate, simpler and more rapidly performed than any of the existing methods.

Gold ores containing stibnite have been leached with alkaline sulphides at the Northwest station. A report covering all the work done on antimony at this station will be published at a later date.

Co-operative work by the Bureau of Mines and the University of Idaho on the theory of flotation is in progress at Moscow, Idaho. Some very interesting facts on the absorption of oil by minerals have been developed, which will be given later in a detailed paper on the subject.

Investigation work on the mill sludges of the Wisconsin zinc mining district is being directed by the Mississippi Valley station at Rolla, Mo. Work has been done on the tabling of sludges and fine tailings. The system of floating the sludge table concentrates has been simplified. The system of flotation has been changed so that the "oil rock" impurity can be more effectively removed than heretofore. Several series of tests on various sludges have been made by this improved system.

A study of Neumann bands in steel is underway at the North Central station at Minneapolis, Minn.

A co-operative agreement between the Bureau of Mines and the Graphite Producers Association for an investigation as to the possibilities of a more extended utilization of American graphite is under consideration.

An investigation of various deposits of clay, mica, schist, slate, marble, talc and kaolin in Alabama, Georgia, Tennessee and North Carolina with regard to their suitability for use as mineral fillers is being undertaken by the Southern Experiment Station at Tuscaloosa, Ala.

A series of observations is being made in the brown iron ore district of Alabama for the purpose of determining definitely whether the dip compass can be relied upon in the location of ore deposits. A study of the method of mining and handling the ores of this district is also being made by the Southern Experiment Station.

PETROLEUM INVESTIGATIONS

J. H. WIGGINS, petroleum engineer of the Petroleum Experiment Station of the Bureau of Mines at Bartlesville, Okla., has completed a report on the effect of insulation on the rate of evaporation on straight-run gasoline in storage, which will later be included as a chapter in a bulletin on methods for reducing evaporation losses. He has also completed a report on pipe line losses, with particular reference to losses due to evaporation of crude at pumping stations on trunk pipe lines. Assisted by Ludwig Schmidt, Mr. Wiggins is conducting a field investigation on methods of reducing evaporation losses of crude oil while stored on the lease. This investigation will furnish oil field operators with data on evaporation losses under conditions which exist on a large percentage of the leases in the Mid-Continent field.

M. J. Kirwan, petroleum engineer, and F. X. Schwarzenbek, assistant petroleum technologist, of the Bartlesville station, are investigating underground conditions in the Deaner field in Oklahoma. A sub-surface contour map of the Kingwood sand has been completed, as well as a contour map of the Deaner sand. A number of cross-sections have been prepared in order to show the location of water in relation to the oil-bearing portion of the sand. E. L. Sproat, geological engineer, has constructed a peg model of the Deaner pool, which brings out the location of the oil, gas and water sands as well as other interesting information on underground conditions, and which will later be set up in the Okmulgee Chamber of Commerce for the purpose of showing operators the importance of underground studies. Distillations of samples of oil from the Deaner field show that the oil is of very good quality, containing approximately 30 percent gasoline and naphtha, and furnishing a fairly satisfactory crude for the production of cylinder stock.

D. B. Dow, assistant organic chemist, has prepared a report on methods of blending natural-gas gasoline, giving the results of work done for the purpose of finding a blending material that could be produced more cheaply than 50-52 naphtha and which at the same time would give a product that could be blended with straight-run gasoline without raising the endpoint of the final product. Mr. Dow has also been working on methods for measuring vapor tension of natural-gas, gasoline blends. A method for measuring vapor tension that looks promising has been developed, although sufficient tests have not yet been made to demonstrate that it can be used to advantage by the natural-gas gasoline industry.

CERAMIC INVESTIGATIONS

A NEW CERAMIC laboratory, in which investigative work regarding the clays of the Northwest will be conducted, will be installed at the Northwest Experiment Station of the United States Bureau of Mines, on the campus of the University of Washington, at Seattle.

The laboratory work in connection with a general study of the clays of Washingto has been completed, and a bulletin on the subject of Washington clays is now in course of preparation.

At the Northwest Experiment Station an attempt is being made to remove iron and silicon from kaolin to produce either millimanite or the oxide of aluminum. Clay was melted in an arcing furnace in presence of carbon; some silicon and iron were volatilized and some reduced to metal. The product contained less iron oxide and silica and more alumina than previously, but not in sufficient amounts to be sillimanite. The refractoriness of these products is to be determined by the ordinary tests.

A co-operative agreement has been effected between the United States Bureau of Mines and the Central of Georgia Railway for an investigation by the Ceramic Experiment Station, Columbus, Ohio, of the white clay and bauxites through central Georgia along the railroad right-of-way. R. B. Gilmore, formerly ceramic chemist with the Vesuvius Crucible Co., Swissvale, Pa., and H. M. Kraner, formerly ceramic assistant of the Bureau of Mines, have been assigned to this work. Preliminary tests on the effects of low calcination temperatures on the colloidal content of Georgia white clays have been made. By calcining Georgia clay to from 500 to 600°C. the absorptive properties were reduced to those of the English china clay, without materially reducing its plasticity.

Bell and Zoller Mining Company of Chicago, operating Zeigler Mine No. 1 Franklin County, Illinois, hoisted during August 133,666 tons of coal, or an average of 4950 tons per day for 27 days. This breaks all records for the output of any one mine in Illinois or Indiana for any calendar month.

Willard Rouse Jillson, director and state geologist of the Kentucky Geological Survey, with offices at Frankfort, Ky., received the doctorate SC.D. from Syracuse University at its fiftieth commencement, in June. Dr. Jillson is the author of a number of well known books and papers on the oil and gas resources of Kentucky.

NET VALUE FREIGHT BASIS UPHELD ON ORE SHIPMENTS TO SALIDA

By C. H. Farrell

THE Interstate Commerce Commission has recently decided that shippers of lead ores and concentrates from Sunset and Mullan, in the Coeur d'Alene mining district of Idaho, to Salida, Colorado, are entitled to have their rates made on the net-value basis which is in effect at Pueblo instead of on the gross-value basis which the carriers concerned desire to apply at Salida. The commission also authorized the waiver of undercharges on about 450 cars which the carriers were attempting to collect and which would have applied if Salida had been left on a gross-value basis.

The commission's decision will give satisfaction to the members of the American Mining Congress, who have watched the case closely since the St. Louis convention of the Mining Congress adopted resolutions in favor of the net-value basis. The commission reversed the decision of its examiners, who had decided in favor of the gross-value basis. It has been stated by those who have kept progress with the case that a decision in favor of the gross-value basis would have cost the western mining industry many thousands of dollars, since in such event the gross-value basis would probably have been adopted by railroads which have been using the net-value basis.

The complaints which brought about this ruling were filed by the Gold Hunter Mining & Smelting Company, the Ohio & Colorado Smelting Company and the Consolidated Interstate Callahan Mining Company. The Gold Hunter Company and the Consolidated Company mine crude ore in the Coeur d'Alene district, concentrate it at their plants, and ship the products in the form of lead concentrates which contain other metals as well, and the Ohio and Colorado Company owns and operates a smelter at Salida, where it receives the products of the two above-named companies. The rates in question are made, and have been for many years, with respect to the value, the lowest rate applying on a value not exceeding $60 per ton and being graduated up as the value is increased. The tariffs carrying the rates in question have a provision for determining the value of the ore and concentrates, which is that the smelter returns to the mine or owner before deducting the transportation charges shall be the value to be used in determining the freight charges, except that on shipments routed via the Denver & Rio Grande Railroad the valuation is to be determined by including total contents at gross valuation without deduction for freight, smelting, sampling, handling or other charges. This exception on shipments via the Denver & Rio Grande was not made, however, to apply at Pueblo and some other points. Where the rates were made under the first-named method, namely, the net-value, they were based on the assay value of the ore plus freight charges after deducting charges for smelting, handling, sampling, et cetera, that is, the treatment charges. Where the rates were made under the exception applying via the Denver & Rio Grande Railroad they were made on the gross-value method, that is, by taking 100 percent of the metal contents of the ore at the New York market prices per unit. The Denver & Rio Grande stated that it was its policy to apply the gross-value method but that it did not apply it at Pueblo because it was obliged to meet competitive conditions.

It is customary for the carriers to way-bill shipments at the highest rate shown and for the delivering agent to correct the billing to the proper rate if, upon presentation of a certificate from the smelter works, the valuation thereof is such that shipment is entitled to a lower rate. In the instant case the Ohio & Colorado Company rendered certificates to the Rio Grande upon which the rates were ultimately assessed and paid, and it developed that these certificates were being made on the net-value plan regardless of the provision that gross-value should be used on shipments via the Denver & Rio Grande. The carrier rendered a bill for the difference between the ates that had been paid and those which would have accrued if the gross-value plan had been followed originally. This bill resulted in the complaints which the Interstate Commerce Commission has just adjudicated, in which it was charged that the rates which would result if gross-value were used would be unjust and unlawful, unjustly discriminatory and unduly preferential.

The situation was simply that the carrier were trying to apply to shipments to Salida rates based on one valuation and to shipments to Pueblo rates based on a different valuation, with the result that Pueblo ultimately paid the lesser charges. Witnesses for the Smelting Company contended that their company believed it had the right to use the net-value method because it was applied at Pueblo, a more distant point, and that it felt justified in assuming that the Rio Grande knew of and accepted the method used in reaching these valuations, namely, the same one as applied at Pueblo. The commission, in reaching its conclusions, found that the net-value basis was used in Western territory by practically all carriers except the Rio Grande, and that that line used the net-value basis wherever it was obliged to meet competition. The evidence also disclosed that while there can be manipulation to secure lower rates under the net-value method, it is also true that the gross-value method is open to the same objections. There was no evidence that the net-value rates were less than reasonable and compensatory or that the higher gross-value rates on the Rio Grande have been or are justified because of more difficult and more costly operating conditions on that line. It was found that both the Rio Grande and the Northern Pacific were "clearly guilty" of undue prejudice to Salida and undue preference of Pueblo by joining in rates from the same points of origin on the lower basis to Pueblo and on the higher basis to Salida.

FREIGHT REDUCTIONS GRANTED; MORE IN PROSPECT

FOR THE FIRST TIME since the beginning of federal control, the shipper can look forward with some real hope to a reduction in rates. Just as long as the provision of the law which requires the Interstate Commerce Commission to keep rates up to a level which will produce 5½ percent or 6 percent return on a value fixed tentatively for rate-making purposes is in effect, unless we get a return to normal tonnage, there will be only faint hopes of any substantial reductions in rates. However, all concerned have at last reached the conclusion that traffic is now paying all that it can bear, and there is an indication that rates in the future will be made at least to some extent with due consideration to the welfare of the industries affected even though a showing that the rates are unreasonable from a transportation standpoint cannot be made.

In a general complaint attacking the rates on live stock in Western territory almost the entire record was devoted to a showing that the industry was in dire need of reduced rates, and not, as has been the practice in the past, to a showing as to the unreasonableness of the rates. The result was an opinion by the commission which recommended that the carriers lower the rates substantially, although the commission was not ready to make a finding of unreasonableness and order in the lower scale. Following this opinion the carriers went to the commission witn applications to file reduced rates in line with the opinion, effective September 20, and those applications were granted. It is significant that the commission, contrary to its usual policy in making the announcement of these reductions, did comment upon the fact that the reductions will result in an amount which has been estimated to be upwards of ten million dollars, and the statement concluded:

"It is the hope of the Commission that the reduced rates will prove of material benefit to the western live stock raisers, who have been heavily affected by the rapid decline in ive stock prices since July, 1920."

Only a few days before the commission had announced approval of applications for authority to make reductions, on five days' notice, in the rates on sand, gravel and crushed stone, between practically all points in trunk line territory. These are the rates for which the building material people have been contending so earnestly for a long while, and the commission in making this announcement stated:

"A large volume of movement of these commodities for roads, buildings and other construction work, will be affected and it is expected that the annual reduction in transportation charges will be much in excess of a million dollars."

In the past few days there has also been announcement made as to substantial reductions in the rates on grain, and the whole grain rate adjustment in the west is now pending before the commission and many believe that further reductions will be approved.

Leaving the rate situation, which is more favorable than it has been in a long time, we pass on to:

EARNINGS: Here we find an even more favorable situation, because complete returns for the month of July indicate that the carriers had a net railway operating income of $69,485,000, which is the largest month they have enjoyed since October of last year. It also represents an increase of $17,000,000 over June, which was favorable as compared with May. This income produces an annual rate of return of 4½ percent on a tentative valuation fixed by the Interstate Commerce Commission for rate-making purposes, and it is immediately apparent that the roads would be on the basis prescribed in the Transportation Act were it not for the general business depression which keeps tonnage down. This showing in July was made in spite of the fact that total operating revenues were $66,000,000 less than in July of last year, which month showed a deficit of $11,878,000. This increased earning power of a lighter tonnage is made possible not only by the increased rates but most of all by the economies which are being worked out in railroad operation and the reductions in wages which the United States Labor Board allowed to go into effect on July 1. Taking the eleven months since September 1 of last year, when the guaranty by the government expired, the carriers have earned on a basis of 2.6 percent, using the tentative valuation referred to above. As an indication of how the operating expenses of the carriers are dropping it is noted that in the eastern district compared with last year there was a decrease of 32.5 percent, in the southern district a decrease of 26.1 percent, and in the western district a decrease of 26.7 percent. Not only in the reduced rates and the increased earnings can we find comfort, but there is some little encouragement in the figures on:

TONNAGE: Here we find for the week ended September 3, which are the last figures available, that the carriers show a slight increase over the preceding week in the number of cars loaded with revenue freight, for the fifth consecutive time. While this week is below the same week of last year, nevertheless it is the largest one since December 11, 1920, and as it is being compared with the weeks immediately preceding it there is justification in the belief that tonnage is surely but slowly getting back to normal. A normal tonnage plus the wage reductions and the economies in operation which are being put into effect should mean that the carriers in the near future will be earning a fair return upon the value of their property and that the shippers will be paying rates which will promote business and make possible the movements of their commodities.

CAR SUPPLY: We still have on the railroads of America a very large number of cars idle. On August 31 there were 467,815 freight cars not working, and out of that number 221,375 were in need of repairs. The number on August 31 was 23,584 less than on August 23, indicating that the movement of traffic increased during the week.

GREAT POWER POTENTIALITIES OF COLORADO RIVER

THE GRANT by the Federal Power Commission of a preliminary permit to James B. Girand for development of 120,000 horse power at a single site on the Colorado River in Mojave County, Arizona, marks an epoch in hydroelectric development in the southwest.

There is more power available for development on the Colorado than on any other single river in the United States. It has been estimated that the maximum potential energy available for development in the Colorado River drainage basin exceeds 5,900,000 horse power. Of this only 439,000 horse power has been utilized, though there are eight applications now on file with the Commission for development on this river, involving over 3,000,000 horse power of primary power.

Mr. Girand proposes to construct a masonry dam 250 feet high at a point just above the mouth of Diamond Creek to back water up the river about 25 miles, and has already made foundation explorations for the dam under a permit from the Interior Department issued some time before passage of the Federal Water Power Act. As the river is subject to a wide variation in stream flow, special provision must be made to insure a spillway capacity sufficient to discharge the flood waters on occasion, and Mr. Girand will make a special investigation of this feature, one year being allowed under the preliminary permit within which to collect and prepare the data requisite for license.

PETROLEUM LAWS OF ALL AMERICA

JUDGE J. W. THOMPSON, law examiner of the Bureau of Mines, is the author of a publication on the above subject which the Bureau is distributing as Bulletin 206. As its title indicates, the bulletin includes the petroleum laws of the United States, the several oil producing states of the United States, and of Canada, Mexico and the republics of Central and South America. The purpose of the report is to provide a handy volume for those interested in exploration and exploitation.

The petroleum laws of the Spanish-American republics are usually supplemented by decrees of their presidents, which serve the purpose of regulations. Such decrees may not change or annul absolutely a congressional enactment, but they may in effect modify the application and enforcement of the laws. These decrees may be issued at any time, and it is highly important for concessionaires to keep advised as to the latest decree. The same statement applies to the orders in council issued by the Canadian government. The commissions of many of our own states have wide authority in regulating the operations of state laws, and their regulations are subject to change and amendment. Compliance with any such decrees, orders in council, and rules of the state commissions is as essential as obedience to the laws themselves.

Copies of Bulletin 206 may be obtained by writing to the American Mining Congress, Washington, D. C.

Mining and Petroleum Digest

NEW USES FOR COPPER

NOT TO BE OUTDONE by the zinc people, the friends of copper are conducting a semi-campaign in behalf of the extended use of the metal. "Make it of copper" is recommended as a slogan by *Iron Ore* (Ishpeming, Mich.), which thus discusses its uses and proposed uses:

"Copper is the ideal metal from which to make screens, gutters, wire and all articles subjected to the elements that are made from metal. Undoubtedly copper and brass could be applied to many new uses in the making of which a considerable tonnage would be consumed. The automobile and truck manufacturers and the ship builders are the heaviest users of copper; the Ford company alone using about 10,000,000 pounds annually. It will be a surprise to many people to learn that 2,000,000 pounds of copper are used in the making of pins each year, and there is none of this recoverable as scrap, either. Where the pins go is still a mystery to many people. Unaccounted uses include the copper used in naval construction, in boat building, in general machinery manufactures, in hardware not before included, in ornamental work, in bells, boots, shoes, harnesses, trunks and bags, besides the immense amount used in repairs on automobiles, locomotives, ships, etc. Much copper is annually worn out in bearings of locomotives, cars, etc., and this is gone forever. Nearly all the copper used in ammunition is lost, and there isn't the accumulation of scrap that one might imagine. Copper used in roofing lasts a lifetime and does not come into scrap supply. Copper going into bronze and other alloys is not generally recovered when the articles give out.

"New uses for copper ought to be discovered and the metal employed wherever it is practicable. It ought to replace all the substitutes brought out during the war period and for which it serves the customer much better. It ought to be more largely employed in automobile bearings, because the bronze bearing is infinitely better for this purpose. Car users ought to insist on bearings of bronze. The parts subjected to the greatest stresses ought to be made of the best. It would save big repair bills and much annoyance. Every wash boiler ought to be made of copper because it is the most economical in the long run. Copper is the ideal metal for radiators, as it has a much higher radiating power, more than one-half that of cast iron or steel. A radiator one-half the size of the present kind would do more heating or cooling according to the needs of the consumer. In a building the copper radiator would be twice as efficient as the one of iron, would occupy less than half the space of the latter, would be much lighter to handle and less liable to breakages from freezing. On the automobile it would be twice as efficient in getting rid of the heat of the motor, and would need to be only one-half the size of the present radiator. There would be less trouble because of the lesser number of parts. "Make It of Copper" ought to be a familiar slogan in all copper-mining districts of our country. This is the time to get the subject discussed and popularized. Let us all plan to have it made of copper wherever possible."

COL. JACKLING IS TOLD HOW TO GET WAGE INCREASE

AN AMUSING OCCURRENCE took place in Salt Lake City and the following account thereof is taken from the *Salt Lake Tribune:*

Col. D. C. Jackling, chairman of the board of the Utah Copper Company, was interviewed by an agent of the Salt Lake office of a correspondence school the other day in Salt Lake and asked to take a course, the agent not recognizing him.

"You see," explained the agent, "you will get a much better salary after completing one of our courses."

"I see," Colonel Jackling replied. "How much do you get a week might I ask?"

"Why, almost $40 a week," replied the agent.

Just then a third party stepped up and addressed the prospect by name, whereupon the agent fled.

CLARK IS OPTIMISTIC ABOUT COPPER FUTURE

ABOUT A YEAR WILL ELAPSE before the copper mines are working full force again, in the opinion of W. A. Clark, owner of the United Verde Copper Mine and former United States Senator from Montana. Although the famous "Copper King" is 83 years old, he is still "full of pep" and is thoroughly conversant with the mining situation. Recently he left Butte for San Francisco, where he expected to sail for Honolulu, to be back in New York in October. During a stop-over on his journey, he gave the following statement to the *Oatman Mining Review.*

"This country is too big and the people are too high a grade to remain inactive long. The copper market right now is almost the flattest thing I know of, but it will not remain that way. As soon as things get straightened out in Germany there will be a big demand for copper all over Europe. We could sell copper now, but would not get the price of its production, and I will not sell it that way. Others feel the same, and we have formed a pool in this country of $40,000,000 to protect the copper interests. We have something like one billion pounds of copper ready for the market. This does not mean, however, that the mines will remain shut down until all that is disposed of. Just as soon as there is a demand and the product starts to move, the mines will begin work again. I believe it will be a year before things get going in full blast at the copper mines."

RELATIONS BETWEEN THE MINES AND NATIONAL PROSPERITY

MINING affords a conspicuous example of the unbalanced state of industry generally, in the opinion of the NATIONAL CITY BANK OF NEW YORK. The August financial review of this institution makes use of the figures as to mine tonnage heretofore published by the American Mining Congress, and points out the relation between the depression of the mining industry and the railroads. It continues:

"It is conservatively estimated today that the metal mining industry as a whole is operating at not more than 50 percent of capacity. The inter-dependence of industry is illustrated by the fact that the railroads not only depend upon the mines for the bulk of their revenue, but the mines depend largely on the buying of the railroads for their own prosperity.

"In the copper industry four out of every five men normally employed are today out of work. Wages of those who are working are at their pre-war level—$4.00 per day for common labor in the Rocky Mountain region, as compared with $6 a day during the war.

"On the other hand, wages for common labor at the anthracite mines are from $6.50 to $7.00 a day, representing an estimated labor charge per ton of $4.07, as compared with $1.80 in 1913. Mining thus affords a conspicuous example of what has been referred to in this letter many times before: the unbalanced state of industry generally. The metal miner has been forced by economic conditions to take drastic wage cuts that have brought his pay down to pre-war basis; the coal miner, on the other hand, is working under a national agreement which runs to April, 1922, and has taken no reduction in the wage rate. The high wage rate, is of doubtful value to the bituminous miner, however, because the demand for coal has fallen to about 8,000,000 tons per month, or approximately 30 percent from full production. As a result of high mining costs, high-priced coal is a factor in high railroad charges, while high-priced coal and high railroad charges figure large in all industrial costs, and are among the chief factors in the industrial depression which throws coal-miners out of employment and in keeping up living costs."

HOLDS PUBLIC IS THE REAL EMPLOYER OF LABOR

THE FALLACY that wage controversies concern employers and their employes only is pointed out and ably controverted by the NATIONAL CITY BANK OF NEW YORK in its *Monthly Business Review.* This institution takes the entirely sensible view that the public, after all, is the real employer and that its interests are equal to, if not greater

FREIGHT REDUCTIONS GRANTED; MORE IN PROSPECT

FOR THE FIRST TIME since the beginning of federal control, the shipper can look forward with some real hope to a reduction in rates. Just as long as the provision of the law which requires the Interstate Commerce Commission to keep rates up to a level which will produce 5½ percent or 6 percent return on a value fixed tentatively for rate-making purposes is in effect, unless we get a return to normal tonnage, there will be only faint hopes of any substantial reductions in rates. However, all concerned have at last reached the conclusion that traffic is now paying all that it can bear, and there is an indication that rates in the future will be made at least to some extent with due consideration to the welfare of the industries affected even though a showing that the rates are unreasonable from a transportation standpoint cannot be made.

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In the past few days there has also been announcement made as to substantial reductions in the rates on grain, and the whole grain rate adjustment in the west is now pending before the commission and many believe that further reductions will be approved.

Leaving the rate situation, which is more favorable than it has been in a long time, we pass on to:

EARNINGS: Here we find an even more favorable situation, because complete returns for the month of July indicate that the carriers had a net railway operating income of $69,485,000, which is the largest month they have enjoyed since October of last year. It also represents an increase of $17,000,000 over June, which was favorable as compared with May. This income produces an annual rate of return of 4½ percent on a tentative valuation fixed by the Interstate Commerce Commission for rate-making purposes, and it is immediately apparent that the roads would be on the basis prescribed in the Transportation Act were it not for the general business depression which keeps tonnage down. This showing in July was made in spite of the fact that total operating revenues were $66,000,000 less than in July of last year, which month showed a deficit of $11,878,000. This increased earning power of a lighter tonnage is made possible not only by the increased rates but most of all by the economies which are being worked out in railroad operation and the reductions in wages which the United States Labor Board allowed to go into effect on July 1. Taking the eleven months since September 1 of last year, when the guaranty by the government expired, the carriers have earned on a basis of 2.6 percent, using the tentative valuation referred to above. As an indication of how the operating expenses of the carriers are dropping it is noted that in the eastern district compared with last year there was a decrease of 32.5 percent, in the southern district a decrease of 26.1 percent, and in the western district a decrease of 26.7 percent. Not only in the reduced rates and the increased earnings can we find comfort, but there is some little encouragement in the figures on:

TONNAGE: Here we find for the week ended September 3, which are the last figures available, that the carriers show a slight increase over the preceding week in the number of cars loaded with revenue freight, for the fifth consecutive time. While this week is below the same week of last year, nevertheless it is the largest one since December 11, 1920, and as it is being compared with the weeks immediately preceding it there is justification in the belief that tonnage is surely but slowly getting back to normal. A normal tonnage plus the wage reductions and the economies in operation which are being put into effect should mean that the carriers in the near future will be earning a fair return upon the value of their property and that the shippers will be paying rates which will promote business and make possible the movements of their commodities.

CAR SUPPLY: We still have on the railroads of America a very large number of cars idle. On August 31 there were 467,815 freight cars not working, and out of that number 221,375 were in need of repairs. The number on August 31 was 23,584 less than on August 23, indicating that the movement of traffic increased during the week.

GREAT POWER POTENTIALITIES OF COLORADO RIVER

THE GRANT by the Federal Power Commission of a preliminary permit to James B. Girand for development of 120,000 horse power at a single site on the Colorado River in Mojave County, Arizona, marks an epoch in hydroelectric development in the southwest.

There is more power available for development on the Colorado than on any other single river in the United States. It has been estimated that the maximum potential energy available for development in the Colorado River drainage basin exceeds 5,900,000 horse power. Of this only 439,000 horse power has been utilized, though there are eight applications now on file with the Commission for development on this river, involving over 3,000,000 horse power of primary power.

Mr. Girand proposes to construct a masonry dam 250 feet high at a point just above the mouth of Diamond Creek to back water up the river about 25 miles, and has already made foundation explorations for the dam under a permit from the Interior Department issued some time before passage of the Federal Water Power Act. As the river is subject to a wide variation in stream flow, special provision must be made to insure a spillway capacity sufficient to discharge the flood waters on occasion, and Mr. Girand will make a special investigation of this feature, one year being allowed under the preliminary permit within which to collect and prepare the data requisite for license.

PETROLEUM LAWS OF ALL AMERICA

JUDGE J. W. THOMPSON, law examiner of the Bureau of Mines, is the author of a publication on the above subject which the Bureau is distributing as Bulletin 206. As its title indicates, the bulletin includes the petroleum laws of the United States, the several oil producing states of the United States, and of Canada, Mexico and the republics of Central and South America. The purpose of the report is to provide a handy volume for those interested in exploration and exploitation.

The petroleum laws of the Spanish-American republics are usually supplemented by decrees of their presidents, which serve the purpose of regulations. Such decrees may not change or annul absolutely a congressional enactment, but they may in effect modify the application and enforcement of the laws. These decrees may be issued at any time, and it is highly important for concessionaires to keep advised as to the latest decree. The same statement applies to the orders in council issued by the Canadian government. The commissions of many of our own states have wide authority in regulating the operations of state laws, and their regulations are subject to change and amendment. Compliance with any such decrees, orders in council, and rules of the state commissions is as essential as obedience to the laws themselves.

Copies of Bulletin 206 may be obtained by writing to the American Mining Congress, Washington, D. C.

Mining and Petroleum Digest

NEW USES FOR COPPER

NOT TO BE OUTDONE by the zinc people, the friends of copper are conducting a semi-campaign in behalf of the extended use of the metal. "Make it of copper" is recommended as a slogan by *Iron Ore* (Ishpeming, Mich.), which thus discusses its uses and proposed uses:

"Copper is the ideal metal from which to make screens, gutters, wire and all articles subjected to the elements that are made from metal. Undoubtedly copper and brass could be applied to many new uses in the making of which a considerable tonnage would be consumed. The automobile and truck manufacturers and the ship builders are the heaviest users of copper; the Ford company alone using about 10,000,000 pounds annually. It will be a surprise to many people to learn that 2,000,000 pounds of copper are used in the making of pins each year, and there is none of this recoverable as scrap, either. Where the pins go is still a mystery to many people. Unaccounted uses include the copper used in naval construction, in boat building, in general machinery manufactures, in hardware not before included, in ornamental work, in bells, boots, shoes, harnesses, trunks and bags, besides the immense amount used in repairs on automobiles, locomotives, ships, etc. Much copper is annually worn out in bearings of locomotives, cars, etc., and this is gone forever. Nearly all the copper used in ammunition is lost, and there isn't the accumulation of scrap that one might imagine. Copper used in roofing lasts a lifetime and does not come into scrap supply. Copper going into bronze and other alloys is not generally recovered when the articles give out.

"New uses for copper ought to be discovered and the metal employed wherever it is practicable. It ought to replace all the substitutes brought out during the war period and for which it serves the customer much better. It ought to be more largely employed in automobile bearings, because the bronze bearing is infinitely better for this purpose. Car users ought to insist on bearings of bronze. The parts subjected to the greatest stresses ought to be made of the best. It would save big repair bills and much annoyance. Every wash boiler ought to be made of copper because it is the most economical in the long run. Copper is the ideal metal for radiators, as it has a much higher radiating power, more than one-half that of cast iron or steel. A radiator one-half the size of the present kind would do more heating or cooling according to the needs of the consumer. In a building the copper radiator would be twice as efficient as the one of iron, would occupy less than half the space of the latter, would be much lighter to handle and less liable to breakages from freezing. On the automobile it would be twice as efficient in getting rid of the heat of the motor, and would need to be only one-half the size of the present radiator. There would be less trouble because of the lesser number of parts. "Make It of Copper" ought to be a familiar slogan in all copper-mining districts of our country. This is the time to get the subject discussed and popularized. Let us all plan to have it made of copper wherever possible."

COL. JACKLING IS TOLD HOW TO GET WAGE INCREASE

AN AMUSING OCCURRENCE took place in Salt Lake City and the following account thereof is taken from the *Salt Lake Tribune:*

Col. D. C. Jackling, chairman of the board of the Utah Copper Company, was interviewed by an agent of the Salt Lake office of a correspondence school the other day in Salt Lake and asked to take a course, the agent not recognizing him.

"You see," explained the agent, "you will get a much better salary after completing one of our courses."

"I see," Colonel Jackling replied. "How much do you get a week might I ask?"

"Why, almost $40 a week," replied the agent.

Just then a third party stepped up and addressed the prospect by name, whereupon the agent fled.

CLARK IS OPTIMISTIC ABOUT COPPER FUTURE

ABOUT A YEAR WILL ELAPSE before the copper mines are working full force again, in the opinion of W. A. Clark, owner of the United Verde Copper Mine and former United States Senator from Montana. Although the famous "Copper King" is 83 years old, he is still "full of pep" and is thoroughly conversant with the mining situation. Recently he left Butte for San Francisco, where he expected to sail for Honolulu, to be back in New York in October. During a stop-over on his journey, he gave the following statement to the *Oatman Mining Review.*

"This country is too big and the people are too high a grade to remain inactive long. The copper market right now is almost the flattest thing I know of, but it will not remain that way. As soon as things get straightened out in Germany there will be a big demand for copper all over Europe. We could sell copper now, but would not get the price of its production, and I will not sell it that way. Others feel the same, and we have formed a pool in this country of $40,000,000 to protect the copper interests. We have something like one billion pounds of copper ready for the market. This does not mean, however, that the mines will remain shut down until all that is disposed of. Just as soon as there is a demand and the product starts to move, the mines will begin work again. I believe it will be a year before things get going in full blast at the copper mines."

RELATIONS BETWEEN THE MINES AND NATIONAL PROSPERITY

MINING affords a conspicuous example of the unbalanced state of industry generally, in the opinion of the NATIONAL CITY BANK OF NEW YORK. The August financial review of this institution makes use of the figures as to mine tonnage heretofore published by the American Mining Congress, and points out the relation between the depression of the mining industry and the railroads. It continues:

"It is conservatively estimated today that the metal mining industry as a whole is operating at not more than 50 percent of capacity. The inter-dependence of industry is illustrated by the fact that the railroads not only depend upon the mines for the bulk of their revenue, but the mines depend largely on the buying of the railroads for their own prosperity.

"In the copper industry four out of every five men normally employed are today out of work. Wages of those who are working are at their pre-war level—$4.00 per day for common labor in the Rocky Mountain region, as compared with $6 a day during the war.

"On the other hand, wages for common labor at the anthracite mines are from $6.50 to $7.00 a day, representing an estimated labor charge per ton of $4.07, as compared with $1.80 in 1913. Mining thus affords a conspicuous example of what has been referred to in this letter many times before: the unbalanced state of industry generally. The metal miner has been forced by economic conditions to take drastic wage cuts that have brought his pay down to pre-war basis; the coal miner, on the other hand, is working under a national agreement which runs to April, 1922, and has taken no reduction in the wage rate. The high wage rate, is of doubtful value to the bituminous miner, however, because the demand for coal has fallen to about 8,000,000 tons per month, or approximately 30 percent from full production. As a result of high mining costs, high-priced coal is a factor in high railroad charges, while high-priced coal and high railroad charges figure large in all industrial costs, and are among the chief factors in the industrial depression which throws coal-miners out of employment and in keeping up living costs."

HOLDS PUBLIC IS THE REAL EMPLOYER OF LABOR

THE FALLACY that wage controversies concern employers and their employes only is pointed out and ably controverted by the NATIONAL CITY BANK OF NEW YORK in its *Monthly Business Review.* This institution takes the entirely sensible view that the public, after all, is the real employer and that its interests are equal to, if not greater

than, all other parties to any economic controversy. We quote:

"There are several misconceptions of the wage question which appear persistently in everyday discussion. One is the common assumption that wages are an issue between employers and employes, with nobody else involved. Of course the public is the real paymaster, and in the last analysis the public is composed chiefly of the wage-earners themselves. Whatever they do to the public they do to themselves. The employer is simply an intermediary who plays a useful part by organizing industry and undertaking to pay a fixed wage, but unless he gets full reimbursement from the public he is soon out of business.

"Another common mistake is that which lays all emphasis upon money wages. The value of money is in what it will buy. The standard of living is not fixed in the wage scale; it consists of a certain standard of comfort, certain supplies of consumable goods. The real compensation of the worker for his own labor comes in the products and services of others.

"While prices were advancing the labor leaders were quick to claim that money was nothing but a medium of exchange and did not represent their real compensation. They insisted upon wage increases to compensate for loss of purchasing power, and got them.

"Now the situation is reversed. The farmer is in the same situation that they were then. His purchasing power has fallen off, and his standard of living has been lowered. The labor leaders are not fighting to defend their own standard of living, but to raise it permanently at the expense of the farmer. That may not be their deliberate intention, but it is the effect of what they are trying to do. Moreover, the full effect is not beneficial even to the wage earners, for it disrupts the exchanges and paralyzes industry.

GOVERNMENT BY DISBURSEMENT

THIS IS THE DESCRIPTION of Washington methods used by the *Northwest Mining Truth*. As might be imagined, the editor is greatly exercised along with thousands of others over the orgy of spending which until recently went on in Washington, and is an advocate of economy. We read:

"A friend of ours hit a nail squarely on the head the other day when he said that this was no longer a government of the people, for the people and by the people, but a government merely of disbursement. During the last two decades, and particularly in the last, we have created innumerable bureaus to cure real and imaginary abuses that have crept into the political system, until now, as Governor Lowden has said, we face the possibility of maintaining a government employe for every private citizen. Cautiously, unceasingly and cunningly, the forces of bureaucracy have moved, ever forward to the ultimate end—control of all branches of government. Once a new bureau is formed, a struggle begins to increase its appropriations. Representatives of the people are cajoled and intimidated; vast sums are wasted in publicity designed to put the common people to sleep with opiates of accomplishment; incompetent leeches are grafted on to the government payrolls and over all is a fever of desire to spend the public moneys. Economy becomes an obsolete word. In Washington the importance of a bureau is judged, not by accomplishments along the lines for which it was created, but by its works of disbursement. In our opinion the system has created a condition of intensified government and high taxation that can never be overcome until a clean sweep has been made in Washington. Bureaucracy must be felled and the very roots of paternal government grubbed out. It is folly to imagine that this country is so rich that its spending ability will never be measured. We are almost in sight of the end now. Disaster can only be averted by speedy return to first principles of government and reinculcation in the people of a desire to render real service to their kind and to their country. The barnacles of disbursement have become so weighty the ship of state must be dry-docked and scraped or stand in danger of disaster in the next storm. The initiation which made this country the marvel of the world has been put to sleep in bureaucracy. We are over-governed, over-taxed and in danger of being overturned."

SILVERTON RAILWAY JUNKING PROTESTED

GEORGE E. COLLINS, governor of the Colorado Chapter of the American Mining Congress, is protesting the proposed junking of the Silverton Railway. The following statement of the issues involved is taken from the *Silverton Standard:*

"The railway serves the Red Mountain section and extends to Joker tunnel in Ouray county. The owners have asked the Interstate Commerce Commission for permission to junk the line saying that there is no further use for it. Mr. Collins is of the opinion that the Red Mountain district is far from finished and that during the period of depression the railway should be allowed to discontinue its service but not be allowed to remove the rails. With the rails in place, according to Mr. Collins, there will always be the incentive to renew operations in that district as soon as conditions will warrant, whereas with the rails removed, it would be an impossibility to get another road. If Red Mountain is finished there should be a general junking of all railroads into the great copper camps that depend upon mining alone, but they are in the same condition at present as Red Mountain and surrounding territory."

IMPROVED COPPER OUTLOOK

A BROAD DEMAND for copper is only a question of time, in the opinion of the *Boston News Bureau*. While not so optimistic as to anticipate an immediate complete revival of the industry, the writer notes that the technical position of the metal is becoming stronger. He points out that:

"A survey of the copper situation leads to the conclusion that copper at its current low price levels is one of the cheapest commodities in all the marts of trade.

"The technical position of the metal is becoming stronger. With most of the big producing properties shut down tight, the situation is essentially different from a year ago.

"The manufacturer has the opportunity of a lifetime to secure copper at a bargain. It would be ruinous for producers to operate on a 12-cent copper market. Based on reports of deficits in 1920, and thus far in 1921, curtailment of output will continue unabated until the mines can operate under something like normal conditions.

"A broad demand for copper is only a question of time. The period of exceptional bargains will also come to an end. A big consumptive vacuum will have to be filled either this year or next."

MINING INDUSTRY NOT DEAD, SAYS BULKELEY WELLS

MEN WHO REFUSE TO QUIT should be listened to. They know what they are doing, and their perseverance should be an inspiration to those who are tempted to become discouraged. Proceeding upon this basis of philosophy, the *Daily Mining and Financial Record* (Denver) discusses the Colorado mining situation:

"It was but a short while ago that Bulkeley Wells made the public statement "the mining industry in Colorado is not dead." This statement was a fitting rebuke to those who had inadvertently become laggards in the mining business. Bulkeley Wells is in a position to know what he is talking about. He views the situation in a general as well as a detailed way, measuring Colorado against many other states and provinces that fall within the scope of his activities. He has the added advantage of his mining business in Colorado.

"That statement did not fall on deaf ears altogether. It was one of those that lend encouragement to the men who are working against odds to keep their mining enterprises moving. We hear the statement, "You can't get money for mining." Don't you believe it. It isn't true. There is capital for mining, if you really want to use it for that purpose. Quite true, capital is a little timid about loading itself down with overhead that contributes little or nothing to development or production. Money spent for that sort of overhead is a capital mortgage on the enterprise that must be figured against every ton of ore produced before success or profits can come. The investing public is wise to this and don't you forget it. But show them where their real chances or even speculative chances are good and that is all you will need to do, even at this time of tight money. The money will be forthcoming. It is being provided for enterprises right now.

"The industry must take its feet off the desk and go underground."

GEORGIA MAYOR INDICTED WITH RAILROAD STRIKERS

THAT PUBLIC OFFICIALS sometimes help strikers rather than the employers—or, at least, that they are accused of doing so—is shown by the following news dispatch from Fitzgerald, Georgia, carried in the *Washington Herald:*

"Mayor J. L. Pittman, of Fitzgerald, and eighteen strikers, under indictment on blanket charges of 'interfering with employes' of the Atlanta, Birmingham and Atlanta Railway were arraigned here today.

"The indictments were returned yesterday and practically all of the warrants were served late last night. The indicted men are at liberty under $500 bonds.

"Charges grew out of recent trouble between the strikers and the workers on the railroad. Several trains on the road have recently been dynamited, it is charged.

"The indictment charges Mayor Pittman with conspiracy with the strikers."

NATIONAL EXPOSITION OF MINES AND MINING EQUIPMENT

TEAM WORK is the essential factor for American industry in facing present day economic problems. It was co-operative team play which made possible the effective mobilization of American industry during the war, and it will be co-operative team work which will successfully solve the problems and overcome the obstacles which confront industry now.

The dominating purpose of the American Mining Congress in organizing the National Exposition of Mines and Mining Equipment was to bring together the manufacturers of mine equipment and mine machinery and the representatives of mining operations from every part of the country in order, if possible, to develop closer co-operation and a greater degree of team play.

This National Exposition of Mines and Mining Equipment—the first to be exclusively devoted to the mining industry—will visualize the remarkable story of the growth of mining in the United States and will present an interesting picture talk of the great strides which have been made in the development of labor saving machinery and other opportunities now presented for future development.

In a general way there will be three important divisions to the National Exposition of Mines and Mining Equipment, which will be staged at the Coliseum—the public exhibits, the exhibits representing different phases of the mining industry, and the great body of exhibits presented by approximately 200 representative manufacturing concerns.

Public Exhibits

The public exhibits will form an unusually notable and interesting group. They will include a special exhibit of the oil shale industry, made by the United States Bureau of Mines. The oil shale industry furnishes almost limitless possibilities for the development of future oil reserves and oil production in the United States. The government is paying particular attention to the opportunities which are presented in oil shale, and the fact that the Bureau of Mines is devoting its entire exhibit to this subject should be an incentive to further development on the part of individual producers. In addition to the oil shale exhibit there will be an unusually interesting exhibit from the United States Geological Survey, a department of the government which has done such effective work in opening up new fields for the development of mining enterprises and in keeping the mining operators fully informed in regard to mineral development. These two exhibits will be features of the central plaza of public exhibits.

Alaska presents unlimited opportunities for further mineral development. Few people in this country have appreciated its importance as a reserve store-house of mineral wealth or realized the opportunities which it furnishes for permanent settlers. The territory of Alaska has appropriated a special fund in order to make its exhibit at Chicago a special feature of the convention.

The relationships between the United States and Mexico are steadily improving. Millions of American capital have been invested in Mexican mineral development and it is believed that there will be a very close co-operation between Mexico and the United States during the coming year. The Mexican exhibit will illustrate the mining opportunities which are presented in the individual states of Mexico and will give to the average spectator a particularly interesting picture of ore samples and of mineral development.

JOHN E. MILLER,
Superintendent of Exposition

In addition to these two remarkable exhibits there will be interesting exhibits from a number of the great western states which will illustrate mining development and opportunities for further mining enterprises. Special attention should be given to the exhibits from California, Utah, Colorado, Arizona, and the purely mining districts in other states. Plans are being worked out for an especially representative exhibit from the great mining district along Lake Superior, including the famous iron mines of the Mesabi range and the development in the Michigan peninsula and in Wisconsin.

Plans have been made for special exhibits of the coal industry, including educational exhibits to be furnished by the Anthracite Bureau of Information and by several of the bituminous coal operators associations. Few laymen appreciate the cost problem in the production of coal and as far as possible this exhibit will bring out effectively some of the important cost factors and the reasons for increased prices in coal production.

The exhibits presented by manufacturing firms at the National Exposition of Mines and Mining Equipment will furnish the largest group of mine equipment, mine machinery and other mine apparatus that has ever been assembled in the United States.

There will be approximately 200 different manufacturing concerns represented at the Coliseum in Chicago and the machinery and equipment shown will range all the way from 22,000-pound loading machines to the most delicate recording and weighing instruments. Underground loading is a factor in mine production which is steadily growing in its importance and its significance. There will be a number of different types of underground loading machines shown in Chicago, as well as some interesting devices for the cleaning, grading and separating of coal.

The metal industries will be well represented in connection with manufacturing exhibits. There will be concentrating tables, grinding machines and other forms of metal mining equipment and machinery.

The entire exposition has been so staged as to make it an extremely attractive exposition and an unsurpassed opportunity for securing full information relative to the latest forms of different types of mine equipment and mining machinery.

Entertainment at the National Exposition of Mines

The management of the convention and the exposition realizes that exhibitors desire to have the general public as well as the mining men present at a great national exposition of this character. The entertainment features of the National Exposition of Mines and Mining Equipment have been worked out in order to emphasize some of the old time contests which have been so colorful a part of the mining development in the United States.

Arrangements have been made whereby different teams of Cornish wrestlers from mining districts, particularly in the copper regions of Northern Michigan and the iron ore regions in Minnesota, will compete in prize contests for the entertainment of the spectators at the exposition. Cornish wrestling has long been the sport of the mining districts and these contests will furnish plenty of action and a great deal of interest. Other arrangements have been made for entertaining the spectators at the National Exposition which will be opened Monday night,

October 17th, at 8:00 P. M. with formal ceremonies.

The national Exposition of Mines and Mining Equipment is an important feature of this great meeting in Chicago, and the following representative firms will exhibit their equipment:

Ludlow-Saylor Wire Company.—Visitors to this company's exhibit, space No. 77, will be glad to find there Mr. J. E. Robertson of El Paso, and Mr. E. M. West of Salt Lake City, both on the lookout for their many friends among the mining fraternity. Many will enjoy the renewal of old friendships with Mr. Frank Low, vice-president and general sales manager of the St. Louis concern.

"Perfect" double crimped wire cloth and Rek Tang rolled slot screens, equally well known throughout the mining game, will be exhibited in connection with their various uses in ore handling. Jig screens, shaker screens—stamp, chilean, trommel screens—all are represented, from heavy space cloth for rock crushers down to the finest meshes.

A special feature of this exhibit is a display of "Perfect" double crimped wire cloth and Rek Tang rolled slot screens in connection with the Mitchell vibrating screen.

Novo Engine Company will have on exhibition a type OH Hoist, with a six H. P. engine. This is a very popular prospector's hoist and one of the chief advantages is in the fact that it can be disassembled for mule-back transportation. They will also exhibit a Type W 10 H. P. pump and a Type U 6 H. P. pump. These are high pressure pumping outfits, both of which are used extensively for supplying water under unusual conditions, where the source of supply is a considerable distance from the place of operation.

The exhibit will also include a 10 H. P. Type DH Hoist and an 8 H. P. Type M Hoist. These hoists are used for general purposes about the mine.

Information will be available at the booth in connection with all of the various types of outfits as manufactured by the Novo Engine Company. The complete line of Novo equipment consists of gasoline and kerosene engines from 1½ to 15 H. P., air compressor outfits, pumping outfits, will be exhibited.

The booth will be in charge of Mr. H. G. Holmes, chief engineer of Lansing, and Mr. George C. Schaeffer of the Chicago office.

Addressograph Company.—This exhibit will be equally attractive to mine operators, superintendents and manufacturers and dealers in mine equipment. In their booths this company will have on display the latest model addressographs, ranging from the small desk models to the larger electrically operated, automatic feed machine.

The addressograph prints names, addresses and data from indestructible car index metal plates embossed with a simple to operate graphotype, by any clerk. No experience is necessary to operate either machine.

The use of the addressograph in connection with time keeping and payroll systems is simple. There is an address plate for each employe, bearing the name, his clock number, occupation, hourly rate, etc. Through the simple "cut-off" attachment any part of this data or all of it can be imprinted on clock cards and pay envelopes, or, with another attachment, names and numbers may be listed evenly on payroll sheets, etc., fifteen times faster than by pen or typewriter.

It also is used with equal facility for inventory and cost record keeping in shop, office, factory or mine. It prints exact typewriter style, fifteen times faster than hand methods, neater and with absolute accuracy.

The ribbon print addressograph "fills in" form letters with names, addresses, personal salutations (My dear Mr. Doe) and dates, with as good a "match" as best typists can obtain.

Magnetic Manufacturing Company.—This company's exhibit, in booth No. 98, will consist of a type "D" Laboratory High Intensity Magnetic Separator and a "high duty" magnetic pulley separator. Both machines will be motor driven and demonstrated in operation.

The type "D" magnetic separator will be used for testing and separating samples of various ores and minerals. All samples will be tested free of charge. This machine is particularly adapted to the concentration of such ores and minerals as zinc, lead, tin, tungsten, monozite, chrome, manganese, etc.

The "high duty" magnetic pully separator will be operated to demonstrate the value of this equipment in mines and mills as a protector of crushing, pulverizing and grinding machinery.

Bulletins describing the above and other Magnetic separators manufactured by this company will be available.

The company will be represented at the exhibit by Messrs. R. H. Stearns, J. P. Bethke and G. H. Fobian.

John A. Roebling's Sons Company will display at the exhibit of the American Mining Congress in Chicago on October 17 to 22, a number of glass covered cases containing samples of wire rope in its various grades and constructions. Wire rope fittings and wire rope slings in miniature will also be exhibited and a number of cases will contain examples of the proper method of attaching wire rope sockets and wire rope clips and also a line of insulated wires and cables. Catalogs on wire rope and wire rope slings will be in the booth.

Duro Metal Products Company will have on exhibit one lilly hoist controller mounted on pedestal, and having solenoid, valve, and brake regulating mechanism arranged in unit for application on electric hoists having oil or air operated gravity brakes.

One lilly hoist controller mounted on pedestal and having weighted arm, latch, and regulating cylinder for application on small hoist with hand brakes.

One lilly hoist controller with standard auxiliary equipment, as furnished for steam hoists with steam or air operated gravity brakes.

One of the controllers will be fitted with a Man-Safety attachment, to protect men by holding the speed of the hoist down to that required for men, stopping the hoist at the man landing, and showing lights in the engine room and at the shaft, to prove that the mechanism is in operation. There will also be a supply of parts from which the lilly controller is made, showing the class of workmanship, finish, and construction.

One of the controllers will be in operation to show the action of the cams, alarm bell, brake regulating equipment, etc.

Roberts and Schaefer Company are specialists in the designing and building of coal mining plants, coal washing plants, locomotive coaling stations, coal dock bridges, and coal storage plants.

They have developed and maintain an organization complete in every department for the expeditious and economical execution of such work.

They have maintained their position in the front rank of the profession by continually inventing, perfecting and placing on the market equipment for the better preparation and more careful handling and loading of coal. Some of their more noted achievements along this line include the following: The Marcus Horizontal Screen and Picking Table, the "Rands" Shaker Loading Boom, the perfecting of the Stewart coal washery, with many modifications and improvements of this system of cleaning coal, the balanced bucket type of locomotive coaling stations, including many special devices such as automatic feeders, automatic distributing cars, specially designed, automatic hoists, etc., the new shallow pit, balanced bucket coaling station; steam sand drying plants; improved cinder handling plants, a portable locomotive coaling and storage plant, the new Balanced Marcus Horizontal Screen and Picking Table, the new shallow pit automatic skip adapted especially for mines of large production.

Working models of some of this interesting equipment, also large photographs, illustrating typical plants including this equipment, may be seen.

Dings Magnetic Separator Company.—This company's exhibit may be found in Booth No. 193. Representing this company will be Messrs. E. S. Hirschberg, J. R. Manegold and R. A. Manegold.

They will show two new machines involving magnetism. The "Davis Magnetic Tube Analyzer" is a small laboratory machine weighing about 200 pounds and is the only machine capable of giving a correct and quick physical determination of the amount of magnetic ingredients in any sample. It was developed primarily for determining the amount of available iron on the Mesabi Iron Company's deposits in Minnesota. This little machine was used to determine whether or not a $3,000,000 plant, which is now under construction and will be completed next spring, should be built and which plant will ultimately resolve itself into a $10,000.000 or $15,000,000 installation.

Another machine, which is also very new, is the Davis Magnetic Log Washer. The log

washer is a modified ordinary log washer with magnetic plates at the bottom. The spirals agitate the finely ground ore, and the magnetic plates at the bottom attract the magnetic, and permit the non-magnetic to be discharged as pulp.

Heretofore it has been impossible to concentrate very finely divided ores containing magnetic qualities with the ordinary Magnetic Separator. The slime and such finely divided portions as will pass through 100 mesh, were always difficult to handle. The Magnetic Log Washer was designed primarily to handle these fine sizes.

In addition to these machines they will show a Magnetic Pulley such as is used extensively in the mining industry for protecting crushers and grinders from tramp iron.

All of the equipment will be connected to the electric circuit and will be in operation during the show.

Coal Industry will occupy booth No. 36 and will distribute the October Convention Number of the *Coal Industry* which will contain a complete account of the following conventions, as well as papers delivered at the respective meetings:

The Sixth Annual International First Aid and Mine Rescue Meet, held in St. Louis, September 1, 2, and 3.

The National Safety Council Annual Convention, held at Boston, Mass., September 26 to 30

The Huntington Coal and Industrial Convention, as well as The West Virginia-Kentucky Association of Mining, Metallurgical and Electrical Engineers' Convention held at Huntington, W. Va., September 19 to 24.

The American Institute of Mining and Metallurgical Engineers' Convention held at Wilkes-Barre, September 12 to 17.

They extend the heartiest welcome to everyone and will see that visitors are supplied with cigarettes and cigars, etc.

Hazard Manufacturing Company will exhibit a short length of 2¾-inch diameter crucible steel wire rope, the largest size steel rope in regular use. The breaking strength of the rope is approximately 211 tons and the safe working load, on a straight pull, 42 tons. This rope is used in a 4000 foot length on a balanced plane with a grade of 15 percent, hauling about 200 tons per trip, and the average life of the rope as determined by the work done, is 6,000,000 tons.

Display boards and individual samples will illustrate the various types of wire rope used in mining operations, including shaft ropes, slope ropes, haulage ropes, and extra flexible ropes for room hoists, scrapers, etc.

The Hazard Company has made a specialty of its "Spiralweave" electrical cable for current distribution in coal and metal mines. "Spiralweave" is their trade name for an extra heavy loom-woven covering applied to mine power cable. It is especially effective where there is danger of damage from abrasion, or from acid water or from electrolysis.

Hazard "Loreca" reel cable for cable reels on gathering locomotives, is made under U. S. etters patent issued in 1919. The patented construction prolongs the life of the cable by eliminating the principal causes of failure in reel cables, i. e., rapid wear from abrasion and cutting and stripping of the insulation and braids.

It is noted that the Hazard Manufacturing Company devotes all its energies in its Copper Department to rubber insulated wires and cables, having satisfied itself that this type of insulation is best suited for practically all classes of electrical distribution.

Various kinds of electrical cables for shaft and borehole suspension will be exhibited.

An unusual feature is the display board showing in detail the component parts of a rubber insulated cable and the various manufacturing processes, from the copper ore and crude rubber to the finished cable.

Meyers-Whaley Company.—This exhibit will occupy spaces Nos. 16 and 17 on the Main Floor of the Coliseum, and will consist of photographs, transparencies, drawings, and one Standard Meyers-Whaley Shoveling Machine complete and in operation.

THE Chicago Flag & Decorating Company has the exposition contract for the decorating of booths and their installation. It is hoped that all exhibitors will get in touch with this company, as the management desires all work upon exhibit booths completed well in advance of the opening date—October 17. This company will rent desks, chairs and any other furniture, supply carpets and potted plants, do carpentry work, make signs, and provide any other assistance desired. They have been in business for twenty-five years, and were awarded the gold medal at the San Francisco World's Fair for the best design and decoration on the Disston Saw Company's exhibit.

Myers-Whaley machines have been in use for 10 or 12 years in many different classes of work, including coal, iron ore, lead ore, rock salt, limestone, gysum, shale tunnel mucking, etc. The machine on exhibit embodies the latest improvements made by the Myers-Whaley Company. It demonstrates the extent to which the Myers-Whaley Company has standardized its machines. Every part of this machine is interchangeable with parts of other Myers-Whaley machines of the same size. It illustrates the type of construction which years of experience have taught to be essential in machines to meet the exacting and heavy duty of loading rock, ores, coal, etc., into mine cars.

The machine will be in operation and show the very interesting M-W shovel motion, the most effective and efficient automatic shoveling device that has ever been designed. It will also show the flexibility of the machine and the ease with which the shovel is swung from side to side and the machine propelled.

An attendant and representative will be on hand to operate the machine and to answer questions.

Tool Steel Gear and Pinion Company will have on exhibit a large section of a coarse pitch cut tooth gear showing approximately a 3/8 inch to ¼ inch depth of treatment. They are doing this class of work with this depth of treatment right along and handling a class of gears much larger and heavier than has ever been undertaken in heat treatment work. They are manufacturing constantly large rim gears for tube mill work in the cement plant industry. These gears will run approximately 127-inch in diameter by 13-inch face and weigh on an average about four tons apiece. They have evolved a method of handling this material that makes the distortion and warpage quite negligible in work of this size, and the increased life of the material is beyond comparison with other grades of gears.

Nordberg Manufacturing Company.—This company are well-known builders of hoisting machinery, air compressors, steam engines and large Diesel engines.

Owing to their machinery being of such a special nature and large size, it will not be practicable to exhibit any of their products. However, large photographs, drawings and literature descriptive of what they have accomplished in the way of furnishing equipment to mines, will be displayed.

They will keep open house at their booth, and will be glad to have you call. A register of visitors will be convenient so that those desiring literature or any other information pertaining to their machinery, can have same mailed to them.

A representative of the company from Milwaukee will be in attendance at the booth for the reception of visitors.

American Blower Company will have an exhibit which will feature their Sirocco and Ventura Mine Fans. A wooden model of a reversible Sirocco Mine Fan will be shown together with various types of Ventura Mine Fans. There will also be one item which will probably attract considerable attention; that is, the "Watch the Ball" outfit. This outfit consists of a small Sirocco Fan holding a ball in mid air while the air is blowing out. The ball is suspended in mid air through the action of the air from the fan and this outfit always attracts a great deal of attention at any exhibit. There will also be a Sirocco Fan, No. 2½ in size, which are furnished for the Anaconda Copper Mining Company.

The fact that the American Blower has specialized to such an extent on mining equipment, including coal mining, copper, etc., means that their exhibit at the Mining Congress and the information which they are in a position to give to those interested should be of considerable interest and really worth while.

Stonehouse Steel Sign Company will show a complete line of signs and tags for accident prevention. In 1912 the Stonehouse Company took an active interest in Safety matters and developed a small line of signs made of 18-gauge steel, fire fused porcelain enameled finish for use in the mines where permanency of code and other signals was essential. Other accident prevention sign which were designed to meet the approval o

safety engineers and the various other safety bodies were added to the line gradually until this company's line of stock signs now reaches well over a thousand. They devote all of their time and effort to this one thing—Signs and tags for accident prevention. The Stonehouse Company have made codes for nearly every state in the Union and these all differ. Some of the codes are quite similar, others vary widely. Some day it is to be hoped that there will be a Universal Code of Mine Signals, probably a Federal Code. This is hoped for, because it will be the means of eliminating much confusion and many accidents and is in line with the standardization policy now in public favor.

Hercules Powder Company are leading manufacturers of explosives, blasting supplies and naval stores, their exhibit being located in booth 31. This exhibit will be prepared with the idea of presenting all of the latest developments in explosives and blasting accessories, as well as those which are already recognized as standard amongst coal and metal miners, quarrymen and others whose operations require the use of explosives. The educational possibilities of an exposition of this kind will not be overlooked and samples of raw materials together with photographs and descriptive literature of the steps necessary in the manufacture of explosives will be available to visitors who are interested. Inasmuch as the Hercules Powder Company are now the largest producer of steam-distilled pine oil, the exhibit will also include a complete set of samples of Yaryan pine-oils which have had a wide use in the flotation process ever since their introduction. Men experienced in the uses of explosives and naval stores will be on hand to answer questions which may arise and should any member come with a particular blasting problem of his own in mind, he is invited to confer on this subject with the representatives of this company at the exposition. This will be the greatest opportunity for real service of mutual advantage to the delegate and exhibitor, and it is hoped that many delegates will come prepared to seek information which can be applied to their individual problem.

A Hercules flotation engineer will also be on hand to discuss flotation matters with those who are interested in that subject.

Experience in exhibiting at the American Mining Congress conventions in the past has convinced the Hercules Powder Company that much information of mutual advantage is interchanged and it is confidently expected that the Chicago exposition will not only equal but surpass past conventions in this respect.

Henion & Hubbell Company of Chicago, and the **Harris Pump & Supply Company** of Pittsburgh, Penna., will share jointly booths 18 and 19. Both of these companies make a specialty of pumping machinery and equipment for mines. Various types of mine pumps will be on exhibit and engineers will be present to dicuss problems relative to dewatering mines.

Hardinge Company will show the Hardinge Conical Ball and Pebble Mills with the accessory parts necessary for different classes of operation. The application of the conical mill for crushing, grinding, and pulverizing as applied to chemical, industrial, and metallurgical processes, whether wet or dry, will be illustrated. The particular feature of this exhibit will be one of the small size Hardinge Conical Ball Mills operating under natural conditions. This will be set up completely and equipped with all necessary accessories. The action of the Hardinge Conical Mill which causes larger balls to crush the largest material, and the smaller balls to work on the finer material, will be featured by means of a small working glass model. The following representatives of the company will be in attendance at the exhibit: Messrs. Harlowe Hardinge, J. S. Halbert, and Roberts S. Schultz, Jr.

Mancha Storage Battery Locomotive Company exhibit will occupy booths 196 and 197. Elaborate preparations are under way which promise to make this exhibit one of the livest and most attractive of any in the Coliseum. The present plans call for a complete line of this company's products to be on display, and the various types of Mancha locomotives, with many new features incorporated, will be in operation on a standard mine track representing actual underground conditions as nearly as can be reproduced.

In connection with the locmotives, complete charging equipment consisting of motor generator sets and charging rheostats together with panel boards and recording instruments will be shown in operation.

Plans are laid also to have a very attractive display of the various types of batteries used with the "Mancha Electric Mule" together with the various electrical instruments, and assemblies of various locomotive details which will demonstrate the character of the material used and the accuracy and workmanship in the construction of the locomotives.

The above equipment will be operated by highly trained and experienced demonstrators, and the exhibit will be in charge of representatives with broad experience in the mining industry who will cheerfully furnish any information desired regarding the operation and maintenance of storage battery locomotives, storage batteries, and charging equipment, and provide for the comfort and welfare of all visitors.

American Cyanamid Company will exhibit in booth 45. There will be displayed cyanide made from the air, which was developed during the period of cyanide scarcity four years ago, and is now being used extensively throughout the United States, Canada and Mexico, for the extraction of gold and silver ores. It is produced at Niagara Falls, from nitrogen taken from the air by the means of the Cyanamid process. The steel drums in which the product is shipped will also be on exhibit.

W. M. Lalor Company are manufacturers of automatic water stills. They will exhibit the Improved "Rochlitz" Automatic Water Still, which furnishes a steady stream of pure water free from carbonic acid and volatile impurities without any attention as long as the electricity, gas or steam and the water supply holds out. It furnishes in capacities ranging from one-half to twenty gallons per hour and can be operated by gas, gasoline, kerosene, steam or electricity. There are no parts to corrode, as it is constructed entirely of copper and brass and lined throughout with purest block tin. The cost of producing one gallon of distilled water varies from one-half cent to two cents, according to the kind of fuel used. This still has the unqualified approval of all the leading Storage Battery Manufacturers. Approximately 1000 mines have installed "Rochlitz" Stills to furnish pure battery water for storage battery locomotives and miners' safety lamps.

General Electric Company will not have an exhibition but several representatives of the company will be present at their booth, Nos. 120 and 121, to meet all of their friends. They will be delighted to have anyone attending the convention to call upon them.

Goodman Manufacturing Company does not plan to have an extensive exhibit. Their exhibit will be similar to those of the Goodman exhibits at the past Mining Congress' Conventions and will consist, namely, of large pictures, bulletins, and other literature describing their equipment.

Mining Safety Device Company is planning to exhibit the Nolan Automatic Cagers as they are used at a shaft bottom, and the Nolan Automatic Horn Stop as used on a cage. In order to show the exact operation of these machines at a mine, they will have a shaft bottom on a small scale, with track built on No. 12 rails, a trip of loaded mine cars, a shaft with a cage operating therein. A trip of loaded cars will run down the track and stand against the horns of the Cager. Then, as the cage lands at the bottom, it will open the horns of the Cager and permit the first car to pass to the cage. In doing so, the wheels of the car will move a reset block from its position on the rail, which revolves the rocker shaft and closes the horns in front of the second loaded car. As the car enters cage, it is caught by the cushioned horns on the Stop and held in position for hoisting. The cage rises, car is dumped at the top, and cage returns to the bottom with the empty car. As cage lands the horns on the cage are opened and the empty car passes off, running down the runaround, while the loaded car takes its place on the cage. This operation will be repeated until the whole trip is caged, in order to show the rapid caging of cars without any assistance from the men at the bottom.

The exhibit will be in charge of Mr. James A Nolan, the inventor of the Nolan Caging Systems, and the manager of the Mining Safety Device Company. He will be assisted by his brother, Mr. Dan L. Nolan.

Federal Electric Company will exhibit in their booth, No. 143, electrically operated sirens, siren controls, the National Renewable Fuse and the National Multiphase Fuse, also electric hand lantern. All of the different

types and sizes of sirens will be shown. They manufacture machines in three separate and distinct sizes. The smallest siren is known as the type "A." It has a sound penetration radius of about two city blocks when mounted out of doors and about 300 feet when mounted in a noisy crowded factory work room. It can be operated from any number of points about the property, or from the telephone switchboard, time clock, etc.

The next size larger siren is known as type "B" single head. This machine has a sound penetration radius of from three-fourths of a mile to a mile under ordinary weather conditions. The largest machine we manufacture is known as our type "B" double head. This siren has a sound penetration radius of from a mile and one-half to two miles and is the machine which is ordinarily used by the mining people.

Service Motor Truck Company will exhibit their truck, known as the Service Motor Truck, which will consist of the "Red Pyramid Speed Truck," their model 15, together with a 2½ ton truck, Model 51, and the 3½ ton truck, Model 76. It is the product of four years' development and test. Work on this truck was first begun early in 1917, but was temporarily suspended owing to pressure of war work, building trucks for the U. S. Government.

The Dictaphone Company will exhibit the latest model dictaphones, which are attracting such wide-spread attention throughout the entire continent. In recent years American business men have begun to recognize more than ever that the Dictaphone is not only a machine for use in writing letters, but it is becoming such a convenience to every executive in handling all communications, memoranda, instructions, putting down thoughts as they arise, that more and more companies are considering it an essential part of the equipment furnished every executive. In addition to this some astounding figures of economies which are immediately evidenced with the use of the Dictaphone, have been compiled wherever the Dictaphone has been intelligently installed as a complete system. The Metropolitan Life Insurance Company of New York City saved $40,000 in 1920 with their use, and estimate a considerable increase in savings for this year. We urge all our members to see these latest model Dictaphone and hear from the representative of the Dictaphone Company, who will be in attendance at the booth, No. 173, the facts about these economies and the convenience of the Dictaphone.

Atlas Car and Manufacturing Company will exhibit a low type Storage Battery Mine Locomotive particularly adapted for gathering coal in thin seam mines. The outstanding feature of the Atlas Locomotive is that it is provided with two driving motors mounted in exceptionally heavy driving units similar to the construction used for years on trolley locomotives. On account of the use of two motors the Atlas Locomotive has more power and consequently higher efficiency than other types of low coal battery motors. In addition to the large motor capacity the machine is provided with a patented drive unit of exceptionally substantial design. This drive unit is arranged to house the double spur gear reduction which is used to drive each axle and to provide adequate lubrication and absolute protection for the gearing. The protection of the axle gear itself is exceptionally substantial. The gears, which are of tool steel brand noted for their long wearing qualities, are mounted on ball bearings to insure easy running and accurate alignment throughout their life. The controller has been especially designed for Atlas locomotives and is of very rugged construction, having removable drums, self-aligning fingers and being of metal construction throughout. All of the other accessories are of the same rugged construction so that the manufacturers of these machines claim for their product the longest life and the highest efficiency of any storage battery locomotive on the market.

Fulton-Kenova Mine Car Company, owning and operating the Fulton Pit Car Company at Canal Fulton, Ohio, and the Kenova Mine Car Company at Kenova, West Virginia, will exhibit a wooden mine car such as is being used in the Illinois Field. This car will be complete in all details and will carry the latest improvements. Samples of the plain bearing and Hyatt equipped wheels manufactured at the Canal Fulton Plant will also be a part of the exhibit.

The Kenova Mine Car Company will exhibit a tight end mine car such as is being used quite largely in the West Virginia field. In order to convey to the operators just how this car can be made in both steel and wood, one side will be made of steel and the other of wood construction and one end steel, while the other of wood. This is considered a unique idea and should attract attention. This exhibit will be complete with a display of their standard truck, the axles of which will be fitted with their plain bearing wheel and the various styles of Hyatt equipped roller bearing wheels. There will also be on display some axles and some loose wheels as well as bumpers and hitchings.

The booth will be decorated with photographs of the wheels and various mine cars and during the Exposition Mr. C. K. Myers, President, assisted by Mr. W. H. Taylor, Vice-President, and Mr. W. J. Kearns, Sales Manager, will be present to meet their friends. Advertising novelties, literature and cigarettes will be distributed during the exposition.

Service Motor Truck Co.—In it the principles of Service Scientific Cushioning are highly developed, and the "works" of the truck are carefully protected from each of the five fundamental shocks, strains and stresses to which all motor trucks are subject: (1) Load Stresses, (2) Road Strains, (3) Road Shocks, (4) Driving Strains and Shocks, (5) Braking Strains and Shocks. The entire truck is carried on a three point support, so that all strains and twisting of body, hood, radiator, seat and steering mechanism are also removed from the frame. A quite remarkable improvement is made in the riding qualities. With the front spring arrangement as shown, the lift on the front end of the truck, when one wheel strikes an obstruction, is only one-half of that with the conventional suspension, and the rate of lift is only one-fourth. The result is that this truck rides over rough and rocky roads, or in fact, in territory where there are practically no road at all, with remarkable ease.

Electric Service Supplies Company.—This company's exhibit is being arranged by and under the direction of their Chicago office, Monadnock Building, in charge of Mr. H. H. Johnson. The following representatives of the company will be in attendance during the convention: J. W. Porter, Vice-President; Max A. Berg, Secretary; L. J. Kirby, Sales Engineer; W. J. Koch, Sales and Mining Departments; A. H. Kopprasch, Industrial Department; T. M. Childs, Steam Railroad Department; M. S. Earl, Mining and Industrial Departments; A. W. Dee, Purchasing Department; H. H. Johnson, Mining and Industrial Departments, and B. Barger of the Special Service Department. This company manufactures electrical material, electrical supplies and specialties, used particularly by steam railroads, electric railways, coal and metal mining companies, electric lighting and transmission companies, and industrial plants. Most of the important products manufactured by this company will be on display in their booth, No. 68.

Sullivan Machinery Company will exhibit, in their booth No. 57, Sullivan Hammer Drills, including Rotators of several types, Stopers, Drifters, etc., fully illustrating the very complete line of Rock and Hammer Drills made by this company; the new Sullivan Turbinair Portable Column Hoist; Sullivan Coal Cutter Bit Making and Sharpening Machine; a Sullivan Drill Bit Sharpening Machine of the all-hammer pattern, whose ability to preserve the quality of drill steel while making perfect bits has been demonstrated notably during the past five years; samples of bits and shanks made by these machines; and a photographic exhibit of the company's other equipment. The exhibit will be under the immediate direction of Mr. Joseph H. Brown, Local Sales Manager, Chicago.

Jacobsen and Schrader, Inc., will exhibit an operating model of a complete coal tipple showing the most modern equipment for screening, picking and loading coal. This model will be constructed along the lines of the many successful Jacobsen and Schraeder standardized tipples now installed in various parts of the country. Enlarged photographs of present installations of screens and equipment will be shown, which are of the most modern and efficient type of coal handling equipment on the market. These standardized tipples are the result of the combined effort of some of the country's best mining engineers, constructors and designers of mining machinery, and are offered complete to cover the various methods of operation, shaft mines, slope mines, and strippers. The layouts shown provide for loading on any num-

ber of tracks; the structures are of wood and steel; and of various capacities. The preparation equipment includes the Jacobsen balanced horizontal screen and picking table, the superiority of which has been time-tested and proved.

Frank S. Betz Company will have an exceedingly interesting exhibit for the mine owner and mine operator. This exhibit will include a complete line of first aid and emergency equipment from the smallest first aid packet to complete outfits for mine hospitals and emergency operating rooms. This company has produced steel operating tables and steel office and hospital furniture of the better grade since 1895, and the very modern and reasonably priced equipment offered by them at the exposition will be well worth the time taken to inspect it. A great many of the larger mines and industries, etc., in the United States have already installed Betz equipment. A very comprehensive catalog on first aid equipment including instruments, utensils, surgical dressings, drugs, pharmaceuticals and surgical appliances, is printed by this company and will be mailed to any mine physician, operator or owner upon application.

Southern Wheel Company. This exhibit will consist principally of their Hollow Axle Mine Car Truck, which they have been manufacturing for the past eight years, and at the present time have about 8000 sets in service, many of them under unusually severe conditions. The distinguishing feature of this truck is in the oiling system. The Hollow Axle is filled with grease, or oil, which feeds out of the axle into the wheel by gravity. This system overcomes the action of centrifugal force which is the main objection to the usual self-oiling wheel when running on a solid axle. The Hollow Axles are made of .35 to .40 carbon, cold drawn seamless steel tubing having an elastic limit of from 70,000 to 80,000 lbs. per square inch of area and Brinnell hardness number of 170. Owing to the carbon content, the cold drawing and subsequent annealing, and the tubular section, the Hollow Axle is almost twice as strong as the solid axle which weighs more. The wheel is made in one piece; the only work done on the wheel is to bore the hole for the axle.

Robert Holmes & Bros., Inc. Some very interesting machinery will be exhibited by this company, in their Booth No. 27. There will be displayed a miniature Automatic Car Lift, Sheave Wheels and loading machinery. The machinery will be operated by compressed air, and will afford the opportunity of seeing how this firm has made it possible for any operator to double his output, and cut his labor in half. Both their plain turned groove type and steel lined type Sheave Wheels will be shown to good advantage. Representatives will be on hand at all times during the exposition, and will gladly answer any questions relative to coal handling equipment. Their thirty years in the equipping of coal plants have been well spent, results of which will be seen by the class of machinery which they build, and it is samples of this class that they will show at the expositions. They will appreciate it very much if all visitors will stop at their booth and register.

Mine Safety Appliances Company will exhibit the new Burrell Carbon Monoxide Gas Mask and the Burrell All-Service Gas Mask. These new types give protection against carbon monoxide, the gas which is stated in a publication of the Bureau of Mines to be the cause of more deaths than all other gases combined. The mask was recently perfected at the company's laboratories in Pittsburgh and marks the culmination of years of intensive research work dating from early in the World War. Other standard safety appliances manufactured and distributed by this company will be shown: The Gibbs Oxygen Breathing Apparatus, the Edison Electric Safety Mine Lamp, Oxygen Inhalator, and First Aid Supplies. Messrs. I. A. Palmer and George Knoll of 189 North Clark Street, the company's representatives at Chicago, J. T. Ryan and George C. Nelms, of Pittsburgh, will attend the Congress and be on hand at the exhibit.

Keystone Consolidated Publishing Company of Pittsburgh will occupy Booth No. 146. The Mining Catalog, Coal Edition; The Mining Catalog, Metal-Quarry Edition, and the Coal Catalog, combined with the Coal Field Directory, are the annual catalogs which this company publishes and they will be on exhibit at their booth.

American Manganese Steel Company will exhibit an AMSCO centrifugal pump used for handling slimes, and solids conveyed by water in mineral mines; Grinding Plates for Marcy and Hardinge Mills; Manganese Steel Gears and Pinions, steam shovel dipper teeth, elevator chain, concaves and crusher heads for gyratory crushers; jaw plates for jaw crushers, screen plates for revolving screens; and Gold Dredge buckets. All of this material will will be made of AMSCO Manganese Steel, and a part or all of this is used in practically every mineral and coal mine in operation.

Ohio Brass Company will have a complete display of O-B Overhead Trolley Materials. The familiar designs will be there as well as new products which have been added during the past year. O-B Rail Bonds and Rail Bonding Tools will also be exhibited and Electric Welding Machines of both the dynamotor and resistance type will be shown. The exhibit will include samples of O-B Hi-Tension Porcelain Insulators which are used for distribution and transmission power lines and Crouse-Hinds Headlights for locomotives, sold exclusively by the Ohio Brass Company.

Allis-Chalmers Manufacturing Company will occupy Booth No. 150 which will serve as headquarters for this company and its friends. Owing to the size of their products and their special character, the exhibit will consist largely of photographs showing the company's extensive line of mining and metallurgical machinery illustrating their applications and showing numerous installations.

Streeter-Amet Weighing and Recording Company will exhibit a mine tipple indicating and recording attachment which indicates the weight of the load on the dial and indelibly records the weight on a paper tape. The dial and recording attachment includes all weighing equipment above the scale shackle, such as beam shelf and beam shelf supports, beam stand and beam, and a large writing table conveniently located. The device automatically weighs and mechanically records, depending for the accuracy of its work only on uniformly exact operation of carefully made mechanism, and not on the uncertain human element. The recorders can be attached to any make of scale, provided capacity and design are suited to the work to be done.

Toledo Pipe Threading Machine Company will exhibit its line of pipe threading and cutting tools. These tools are made in various sizes for threading pipe from ⅛″ to 12″ inclusive. All of these tools for threading pipe from 1″ up, embody the rather famous "Toledo" receding die principle, which made possible the threading of large sizes of pipe easily and efficiently by hand. It is entirely practicable for one man to cut a 12″ thread by hand with the No.4 "Toledo" threader. The display will also contain "Toledo" pipe cut-off tools which are made in several sizes, having a combined capacity of 1″ to 10″ inclusive. Visitors to this exhibit will be much interested in the "Toledo" power drive for operating these tools. It is unique in its action.

Chalmers & Williams, Incorporated, with factory and general offices at Chicago Heights, Illinois, will devote their space to the showing of the rotary and travelling types of Ross Automatic Drop Bar Grizzly Feeders and Screens and to the horizontal type of Symons Disc Crushers. They specialize in the manufacture of crushing, screening and feeding equipment of the most modern and improved designs and in addition, are the sole manufacturers of the Burt Filters, and the Ross Automatic Drop Bar Grizzly Feeders and Screens and the Symons Disc Crushers.

Bastian-Blessing Company. The exhibit of this company may be found at Booth No. 148, where they will demonstrate in operation Rego Apparatus for welding and cutting of metals. The method of making emergency repairs with this equipment will be shown by the Rego engineers. Visitors are invited to discuss their problems at the booth. This company has developed in Rego welding and cutting apparatus a tool which is simple to operate correctly. Their patented method of mixing the gas in the torch permits the operator to forget the torch and concentrate his whole attention on the weld, where it belongs, just as a blacksmith is able to forget his hammer and concentrate his attention on the forging. The reason for this is that the Rego torch automatically develops a perfect, neutral flame; there is no chance of the operator oxidizing or burning the material. The Rego exhibit will include their complete line of torches and acces-

sories. This line embodies a torch for every purpose and for every class of work, from the small lead welding torch for use with natural gas to the large torches used for welding heavy casting.

Hyatt Roller Bearing Company are planning to exhibit a model showing the ideal lubricating features of Hyatt Bearings. They will have on display self-aligning roller bearing journal boxes and mine car wheels, containing Hyatt Roller Bearings. The journal boxes and the wheels will be manufactured by the people who utilize Hyatt Bearings and consequently the exhibit will be of a great deal of interest. They will also have a carrier stand for a belt conveyor, and a sample Hyatt Flexible Roller Bearings for mine and ore cars, shop trucks, line-shafting, trolleys, cranes, and hoists, trolley and storage battery mine locomotives, gasoline locomotives, machine tools, etc.

Jeffrey Manufacturing Company of Columbus, Ohio, manufacture machinery and equipment of size that would make it impossible for them to have a display, but you will find at their booth bulletins describing all types of mining machines, locomotives of the trolley, gathering and storage battery type, mine fans, tipple equipment, crushers, elevating and conveying material, etc.

Westinghouse Electric & Manufacturing Company has arranged to combine their exhibit with the Baldwin Locomotive Works this year. Booths 159 and 160 have been contracted for by the combined companies, and the plans are to have a general reception space, i. e., both booths will be made up as one, with the exception that the name "Westinghouse Electric & Manufacturing Company" will appear on one side, and "Baldwin Locomotive Works" on the other. There will be available the various kinds of literature pertaining to equipment manufactured by these companies for the mining industry, such as mine locomotives, both storage battery and trolley line type, which includes the famous barsteel type of locomotive. Also, the literature will describe the Westinghouse mine motors, both A. C. and D. C., for blower hoists, cranes and numerous other motor applications. Also, the necessary control equipment will be fully described. The Westinghouse Company will be represented by Mr. N. G. Symonds of the Chicago Office, and the Baldwin Locomotive Works will be represented by Mr. R. M. Campbell of Philadelphia, Pennsylvania. The booth will be in charge of Mr. G. H. Jaspert, Department of Publicity, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

Sanford-Day Iron Works' exhibit will be in conjunction with the exhibit of the Myers-Whaley electric shoveling machine. Both the exhibit of the Sanford-Day Iron Works and of the Myers-Whaley machine will probably be moving exhibits. They propose to display particularly the operation of their automatic mine car, and to do this will have a miniature coal mine with tip house, tracks and dump, electric locomotive and mine cars running around a track in a similar fashion to the operation at the mine, and discharging coal at the tip house. This will all be in miniature. In addition to this, this company will furnish the Myers-Whaley Company, to be used behind their machine, one standard size automatic drop bottom mine car. They will also have on hand, exhibits of their car wheels of the roller bearing type, the Whitney wonder wheel, which is well known throughout the trade and is used largely throughout Illinois and the east and west, and also an exhibition of a full size model of their S. and D. Master roller bearing wheel, a new design they have gotten out.

Keystone Lubricating Company will exhibit its various mine car lubricants together with special grease guns to provide for the most efficient and economical application thereof. Also grease for use on all types of mine locomotives, mining machines, wire ropes, etc. In addition there will be a special exhibit of their Venango Gravity Feed Grease Cups and Organ Spring Automatic Grease Cups, together with grease for use therein. They will be represented by men of wide practical experience in the solving of difficult lubricating problems in connection with mine operations.

Duntley-King Pneumatic Tool Company of Chicago, will have on exhibition pneumatic tools in operation, consisting of all sizes of riveting hammers, chipping hammers, rivet cutters and electric drills. Further, they will display their complete line of accessories, such as rivet sets, hose couplings, hose, pistons and other pneumatic tool accessories.

Chase Metal Works exhibit comprises a display of manufactured non-ferrous products such as brass, copper and bronze sheet, rod, wire and tubing. Their aim will be to make the exhibit of educational value by showing the successive steps in manufacture from the casting to the finished product. The exhibit will consist of the following products: brazed tubing, showing the original sheet, the forming process, welded seam and finished material; seamless tubing, showing the original billet or cast shell with intermediate sizes during the drawing operations; rod of various alloys, round, square, hexagon and many other shapes, both drawn and extruded. Bronze rods are made for the U. S. Government under very rigid specifications. There will also be a display of sheet brass, ordinary brass alloys, bronze and nickel silver; wire, coils of wire of various composition; and miscellaneous samples of finished products, bent into various forms to illustrate the strength and ductility of rods, wire and tubing.

A. Leschen & Sons Rope Company of St. Louis, will exhibit in Booth No. 60, wire ropes and aerial wire rope tramways. Their wire rope display will consist of samples of wire ropes for all purposes, including their famous HERCULES (Red-Strand) Wire Rope, patent flattened strand wire rope, locked wire rope, locked coil cable, as well as wire ropes in all standard round strand constructions. This large exhibit of wire rope samples will afford wire rope users an excellent opportunity to study and compare the different constructions, and an experienced wire rope man will be present to explain the advantages and the particular uses to which the various types are especially suited. What will probably be the most interesting and entertaining feature of this display will be a working model of a Leschen Gravity Two-Bucket Aerial Tramway. This miniature tramway is modeled after an actual installation in West Virginia that is used for carrying coal from mine to railroad cars. While a model of only one of the Leschen systems of aerial transportation will be shown, they will have on display one of their patented friction grips which are furnished on their heavy duty tramways. This is a system that is extensively used where there are long hauls and large tonnage. Full information on all Leschen Systems of aerial wire rope tramways will be supplied by one of their engineers.

Lake Superior Loader Company will show a mechanical shoveling device that has met with success and favor in metal and coal mines. The machine is a small compact mechanical loader that seems to meet the general requirements for underground conditions. It weighs approximately 4650 pounds and the over-all dimensions are 4 feet high, 4 feet wide, and 6 feet long, small enough so that it can be transferred to any section of the mine where drifts and crosscuts are at least 5 feet x 5 feet. When operating, the Shuveloder requires 6 feet 10 inches head room above the top of rails, and the width in working place should be at least 7 feet to load economically. There are three main parts to the Shuveloder, a truck frame mounted on wheels, a platform to provide the lateral movement; and the body piece containing the operating cylinders and guides in which are the crosshead, sheaves, dipper arms and dipper function. The crowding, digging and loading movements are performed by the action of compressed air on direct thrust pistons. Cables are attached to the two sheave wheels and connected with the pistons of the digging cylinders so that the movement of these pistons revolves the sheave wheels to which are attached the dipper arms carrying the dipper. The air consumption is 150 cubic feet free air per minute at 80 pounds. With this pressure the Shuveloder is capable of lifting a load of 1100 pounds and dumping it into the car behind. The body is swung on the truck frame to either side through an angle of 45 degrees enabling the dipper to clean up a width of 11 feet. Regardless of whether the body piece is in the extreme right or left position, the material in the dipper is always discharged into the center of the car behind. A normal crew with the Shuveloder is three men, one operator and two men for exchanging cars. The average rate of loading under the different conditions that the Shuveloder is operating varies from 12 to 19

tons per hour. This includes all delays, time required for exchanging cars, laying tracks and represents the rate for the total time spent by the shoveling crew from the beginning of shoveling operations until all the material has been removed.

American Mine Door Company's exhibit may be found at Booth No. 194 in the Annex. A number of line and track devices will be shown, such as cable splicer, trolley splicer, bonding terminals, trolley frog, etc., but their main exhibit will be an automatic mine door installed on the railway track immediately back of their booth, also an automatic switch thrower which will be installed at one of the switches leading to the track. Both of these devices will be installed exactly as they would be erected in the mine. The purpose of the automatic mine door is to control the air currents in the ventilating system to guide the air to the working places. The Canton automatic switch thrower is a device which performs every operation connected with opening and closing a switch which can be done by a man. The devices of this company will interest anyone seeking "time tested and proven" automatic labor saving devices.

American Car & Foundry Company of Terre Haute, Indiana, will exhibit a three-ton capacity steel mine car, with three-inch wood floor, 3/16 inch steel sides and 3/16 inch corrugated steel ends. They will also display a standard roller bearing mine car truck. 3 x 7" solid caged rollers, 3¼" hot rolled heat treated steel axle, 40 to 50 carbon with 16-inch wheels. The total weight of this truck is 1175 pounds. There will be five other displays of equipment as manufactured by this company which should attract a great deal of attention and interest.

Rand McNally & Company, Chicago, Ill., will exhibit in space No. 11 their Patented Self-Indicating Coupon Books used by Coal Mine Commissaries. The use of the coupon book as a means of keeping store accounts with employes is recognized as the real, practical method for this particular purpose. The demand for them is increasing, because in operation their use is so simple and their value so great in accounting. Their demonstrators will be in attendance to show how and why the coupon book is superior and more economical than other systems. It will be to the interest of officials and representatives of coal mining concerns to investigate their coupon book system and they are cordially invited to attend this demonstration. They will also exhibit maps for various purposes.

The Timken Roller Bearing Company of Canton, Ohio, will exhibit mine car trucks made by two well known manufacturers equipped with Timken bearings. They will also have other data regarding Timken Bearings which will be of particular interest to mine operators.

The United States Forest Service will make an exhibit to stimulate interest in the preservative treatment of mine timbers. Their plan is to show samples of the various preservatives which are known to be effective and practical, and samples of wood treated with them. Sections of treated wood which have remained sound through many years service in mines will be shown as well as sections of untreated timbers which have decayed after a short period of usefulness. With an automatic lantern slide machine, pictures of conditions in mines, wood preserving equipment and various other photographs pertaining to mine timber preservation will be shown, and representatives will be prepared to discuss various types of treating equipment, and will exhibit photographs and drawings of treating plants suitable for mine timber treatment, and will answer questions and furnish information and publications showing how mine timber is practical and economical.

Service Motor Truck Company of Wabash, Indiana, will exhibit in spaces Nos. 7 and 8 a 3½ ton Service truck with dump body, operated by hydraulic hoist. Service trucks are protected against the five shocks and strains to which all motor trucks are subjected by what has been termed the "Service Method of Scientific Cushioning," which means much in the life of motor truck equipment, especially in such use as it would have in the mining industry, where roads are frequently at their worst and conditions of operation particularly difficult.

The Baldwin Locomotive Works, Philadelphia, will exhibit in connection with the Baldwin-Westinghouse Exhibit, spaces Nos. 159 and 160, two steel tired wheels used in mine car and electric driving service. One wheel has a portion cut away exposing cross section of tire, spoke and hub.

Smith Engineering Works of Milwaukee, Wisconsin, will exhibit two models, one of the Telsmith Primary Breaker and one of the Telsmith Reduction Crusher. The latter feature will be an operating model, with a complete oiling system—a perfect machine on a small scale. It is expected that it will be driven with an electric motor and will give interested parties an actual demonstration of a reduction crusher in action. These exhibits will be in booth No. 129.

Larco Wrench & Mfg. Corporation of Chicago, Illinois, will occupy Booth No. 151 and will have on display the Larco pipe and monkey wrenches which are considered the "greatest improvement in wrench construction in fifty years," which should prove of considerable interest to all who visit the Mining Exposition. The Larco Corporation will display these wrenches on a specially constructed pipe rack so arranged as to permit all interested parties to test these wrenches in a most severe manner. This rack will consist of necessary pipe and fittings so connected as to permit the testing of the Larco pipe wrenches in the usual customary manner but because of the superior strength of the wrenches the pipe rack is fitted in a manner to permit of the most severe "side pulls" to demonstrate the unbreakable Larco Frame. They will also display their automatic nut wrenches. These wrenches will be demonstrated on a specially equipped counter containing various sizes of square and hex nuts so as to demonstrate the speed of these wrenches in automatically adjusting to various sizes of nuts. All users of pipe and monkey wrenches will find this exhibit and demonstration well worth their attention.

Macwhyte Company of Kenosha, Wisconsin, will exhibit a very complete line of wire ropes. This exhibit will be placed in specially designed show cases, the s feature being that a clear view is had of the end section of each piece of rope exhibited. These ropes will consist of hoisting and haulage ropes, also extra flexible wire ropes for mining machines. This Company is the sole manufacturer of the celebrated Monarch Mine Car Hitching which is now being used with great success by a very large number of mines. The exhibit will be in charge of Messrs. H. F. Gerling and James A. Boope, who will be very glad to have everyone interested in Macwhyte Company products call at Booth No. 163.

Concordia Electric Company will occupy Booth No. 87 in which they will exhibit "Ceag" electric safety miners' hand-lamps, cap-lamps, together with charging rack, unlocking magnets and other lamp house accessories. They will also have on display other of their products, such as: "Ceag" electric safety lamps for mine superintendents and foremen, their trip-lamps, mine locomotive headlights, safety mule lamps, and watchmen's lamps. All of these products will be fitted with the famous "Ceag" storage battery, which cannot leak or spill, delivering a constant voltage over the entire discharge period, and having a larger capacity higher efficiency, and lower maintenance cost than any other similar battery in the market.

E. J. Longyear Company's exhibit will be of unusual interest to mining men, in Booth No. 29, showing the various phases of mineral exploration and development. As a result of many years of experience, an organization has been brought together and a system of operation developed for every procedure from the initial geological examination of the prospect to its complete equipment as a mine ready for operation. The exhibit covers the principal activities grouped under mineral exploration, diamond drill manufacturing, and shaft sinking. Under mineral exploration, emphasis is placed on diamond drilling and the engineering and geological aspects of this important branch of mining work. As contractors of diamond drilling, this company's representatives will be in their booth ready to explain and illustrate with photographs some of the contracts that have been completed, and will be prepared to make proposals on future work that visitors may have in prospect. The most approved methods of obtaining and preserving samples will be shown. An interesting feature is the demonstration of actual setting of carbon (black diamonds) by one of the company's experienced operators. They will have on

exhibition maps, models, and geological and engineering records, illustrating the technical principles involved in scientific direction of exploration and in the appraisal of mineral properties. As manufacturers of diamond core drills and supplies, the company will exhibit one of its smaller drills, a "UG," equipped for operation by either steam or compressed air. Other types of core drills manufactured for every requirement are illustrated by photographs and circulars. The shaft sinking activities will be presented by means of models of some of the shaft sunk by the Longyear Company.

PRESIDENT ASKED TO NAME WESTERN MAN AS JUDGE

THE American Mining Congress has requested President Harding to select a Western man as judge of the U. S. Circuit Court of Appeals, Eighth District, to succeed the late Judge William C. Hook. In a letter to the President, the Secretary of the Mining Congress pointed out the necessity of selecting some one familiar with the extra-lateral right law and irrigation laws. Following is the correspondence between the Mining Congress and the Department of Justice, to which the President referred the matter:

Denver, Colo., Sept. 3, 1921.

Honorable Warren G. Harding,
President of the United States,
Executive Mansion,
Washington, D. C.

My Dear Mr. President:

Will you permit me to express the desire of the mining men of the West that in the selection of a successor to the late Judge William C. Hook, of the Eighth District of the United States Circuit Court of Appeals that a man shall be selected who is familiar with the peculiar problems of the Rocky Mountain states?

This is particularly desired in order that the cases coming before this court may have the advantage of consideration by a man who is familiar in a practical way with the two systems of law which do not prevail elsewhere than in the Rocky Mountain region, viz., the extra-lateral right law, permitting the following of a vein of ore upon its dip outside the boundaries of the surface lines, and the irrigation law, which gives to the users of water for beneficial purposes the right by prior appropriation to divert the water from its accustomed channels in violation of the doctrine of riparian rights, which is of almost universal application outside the arid land states.

The American Mining Congress has no candidates for this or any other public office, but it does urge that a Western man shall be selected because of the reasons above outlined.

Trusting that you will give this matter careful consideration and thanking you therefor, we are

Very respectfully,

THE AMERICAN MINING CONGRESS.
By J. F. Callbreath, Sec'y.

September 13, 1921.

Mr. J. F. Callbreath, Secretary,
The American Mining Congress,
Denver, Colorado.

Dear Sir:

The Attorney General directs me to advise you that he has received, by reference of the President, your letter of the 3d instant, expressing the desire of the mining men of the West that in the selection of a successor to the late Judge William C. Hook, of the Eighth District of the United States Circuit Court of Appeals, that a man shall be selected who is familiar with the peculiar problems of the Rocky Mountain States, and to say that the same will be filed for consideration at the proper time.

Respectfully,

W. FRANK GIBBS,
Private Sec'y and Ass't to
the Attorney General.

COAL LEASING AMENDMENT

REGULATIONS governing coal mining leases, permits and licenses under the Leasing Act have been amended by the following addition to the text of Section 8, effective August 10:

"Provided, that in case of lease for a small area where the investment to be made is less than $10,000, the lessee shall furnish one bond to cover both the investment and compliance with the terms of the lease, such bond to be in half the amount of the investment to be made, but in no case shall be less than $1,000."

HANDKERCHIEFS TO YIELD TO RESPIRATORS

AN INVESTIGATION of the various types of respirators used by workers in numerous industries in preventing the inhalation of injurious dusts will be undertaken at the Pittsburgh experiment station of the United States Bureau of Mines.

Stone dusts and metal dusts bseathed by miners, stone cutters and metal polishers have been the cause of much pulmonary disease, incapacitating many workers and at times resulting in early deaths. Investigators have learned that the finest particles of dust, of a size far too small to be seen by the unaided eye, are the ones that lodge in the lungs and do most damage. At present little is known of the merits of the different filtes used for respirators, and workmen often prefer to protect themselves with a towel or handkerchief tied around the face.

The tests will be conducted by S. H. Katz assistant physical chemist, and L. J. Trostel junior chemist, under the direction of A. C Fieldner, supervising chemist.

SHALE RESOURCES CONSTITUTE POTENTIAL RESERVE

IF THE AMERICAN petroleum supply ever falls short of the domestic demand, and foreign oils cannot be obtained in sufficient quantities at reasonable prices, we can depend upon our oil shales to meet the emergency. This is the studied conclusion of the United States Bureau of Mines.

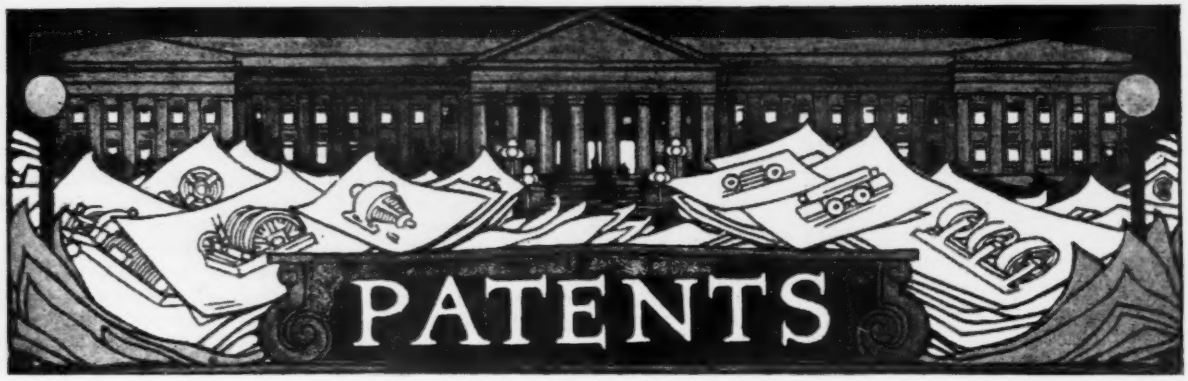
An analysis of the oil shale situation, particularly from the economic angle, has been made by M. J. Gavin, H. H. Hill and W. E. Perdew, of the Bureau of Mines. They give special consideration to the western states, where shale beds are thickest and richest. They agree with prior findings of the Geological Survey that these states contain enormous quantities of shales which can be made to yield hydrocarbon oils to a much greater extent than we can hope to obtain from our oil wells, and that the shales thus constitute a tremendous potential reserve.

PRODUCTION AND SALES OF LIME, 1919-1920

PRACTICALLY the same amount of lime was produced and sold in the United States in 1919 and 1920, according to final calculations of the Geological Survey. The value of the 1920 output, however, was more than $2,000,000 in excess of that of the year preceding. The increase in quantity was 7.2 percent and the increase in value was 27.5 percent, the average value in 1920 being $10.52 per ton as compared with $8.84 per ton in 1919. Comparative figures for the two years are shown in the accompanying table.

Lime Production and Sales, 1919-1920

Use	1919		1920	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Building	1,191,434	$11,484,318	1,305,412	$15,269,683
Agriculture	438,632	3,345,039	351,851	3,096,705
Chemical:				
Paper mills	335,813	2,836,347	365,897	3,844,084
Glass works	44,618	336,020	54,747	551,945
Sugar factories	13,111	163,526	14,145	173,798
Tanneries	59,978	580,022	61,162	668,999
Metallurgy	295,622	2,152,554	344,921	2,836,474
Other chemical	861,022	7,695,818	1,000,550	10,304,049
Total chemical	1,610,164	13,664,287	1,841,422	18,381,349
Total	3,330,347	29,443,553	3,570,141	37,543,840
Hydrated lime (included in total)	777,408	7,061,146	853,116	9,287,562



CONDUCTED BY JOHN BOYLE, JR.

1,382,001—*S. J. Cruly*, Miami, Ariz., June 21, 1921.

SHOVELING MACHINE.

1,382,275—*W. Deister*, Fort Wayne, Indiana, June 21, 1921. Assigned to Deister Machine Co.

ORE CONCENTRATOR of the type which are differentially reciprocated and transversely inclined downwardly in operating position. A sudden drop of the concentrates into a channel over a non-submerged edge of the riffle immediately above the channel is undesirable since the minerals in the channel are thereby continuously agitated and more or less of them are continuously washed out of the channels and over the riffles below in succession down the slope of the deck, whereas it is desirable to retain in the channels all minerals caught therein and to guide them under the influence of the reciprocating movement of the table toward the concentrates discharge end of the deck. The width of the riffles, the sloping portions of their top surfaces and the submerged upper edges of the lower sides or walls of the riffles all contribute to direct the water contained in the pulp in practically a straight line or sheet over the riffle tops and thereby substantially eliminate all excavating action of the water on the materials in the channels.

1,382,276—*E. & W. F. Deister*, Fort Wayne, Indiana, June 21, 1921. Assigned to Deister Machine Co.

SUPPORTING MECHANISM FOR ORE CONCENTRATORS by which any desired transverse inclination of the table may be accomplished, and comprising a plurality of wedge adapted to engage one side of the table, and means for simultaneously operating the same to control the inclination of the table.

1,382,337—*G. C. Bellis*, Butler, Pa., June 21, 1921.

METHOD OF CLEANING OIL WELLS, comprising pouring caustic alkali into the well, permitting it to remain there to loosen the deposits formed on the walls thereof and then pumping out the same.

1,382,602—*A. H. Neilson*, Tulsa, Okla., June 21 ,1921.

MULTIPLE SUCKER ROD SOCKET, comprising a barrel with a downwardly tapering bore, slips in said bore, and means loosely holding said slips together, enabling a greater separation thereof at the top than elsewhere, when moved upwardly in said bore.

1,383,309—*F. E. Johnson*, Salt Lake City, Utah, July 5, 1921. Assigned to American Manganese Steel Co.

MINE CAR WHEEL of the type that are made of alloyed metal, preferably of manganese steel, and which wheels are provided with bushings forced or driven into the hubs for free rotation on the axles, the bushings having a special formation for co-operation with a ring or the like whereby the wheels may be readily applied to or removed from the cars. This construction serves as a means for not only removably securing the wheels to the axles of the housings, but also as a leak-tight joint preventing the escape of any lubricant or oil of any sort from the interior of the housing.

1.383,370—*G. J. Bancroft*, Denver, Colo., July 5, 1921.

PROCESS OF SPLITTING MICA, consisting in heating water soaked material in a closed chamber until the desired pressure is attained and opening the container to suddenly release said pressure.

1,383,380—*S. L. Boggs*, Ivanhoe, Va., July 5, 1921.

SLIME PUMP. The present invention deals with a pump, or conveyor, for moving mixtures of ore or gangue and water. At present either screw conveyors, or centrifugal pumps are used for this purpose

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1,383,881—*J. I. Thomas*, Garfield, Utah, July 5, 1921.

FLOTATION APPARATUS, comprising a gaseous fluid distributor resembling a rotatable propellor, the blade-like body having a porous wall through which the fluid escapes, thereby exerting an impelling action on the distributor to cause it to rotate.

1,384,236—*A. J. Chopin*, Paris, France, July 12, 1921.

COAL CUTTING MACHINE, involving the application to coal cutting of a compressed air hammer and means of supporting the same in adjusted position.

1,384,404—*T. E. Pray*, Chicago, Ill., July 12, 1921. Assigned to Goodman Manufacturing Co.

MINING MACHINE of the cutter chain type, comprising a construction for mounting the cutter bar on the machine frame so as to avoid rotation thereof from one side of the machine to the other, and also to afford tilting of the cutter bar out of its normal horizontal plane so as to follow rolling or uneven floor and to maintain the cutter bar at the proper height.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October, 1921.

City of Washington, } ss.:
District of Columbia, }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared E. Russell Coombes, who, having been duly sworn according to law, deposes and says that she is the business manager of THE MINING CONGRESS JOURNAL, and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:

Name of Publisher—The American Mining Congress.

Postoffice address—Washington, D. C.

Officers:

W. J. Loring, President, San Francisco, Calif.

Daniel B. Wentz, First Vice-President, Philadelphia, Pa.

E. L. Doheny, Second Vice-President, Los Angeles, Calif.

Thomas T. Brewster, Third Vice-President, St. Louis, Mo.

J. F. Callbreath, Secretary.

Editor—T. R. Moss.

Business Manager—E. Russell Coombes.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock): The American Mining Congress—a corporation, not for profit. No stockholders.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): None.

E. RUSSELL COOMBES,
Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1921.

(Seal.) THOMAS C. WILLIS.

(My commission expires February 20, 1922.)

Wear and tear and the welder

IN no other industry is machinery subject to harder service than in mining and nowhere does a breakdown spell greater disaster.

Modern operators avoid breakdowns by employing the oxy-acetylene process in remaking broken parts, building worn surfaces, welding cracks and similar reclamation work.

Prest-O-Lite
DISSOLVED ACETYLENE

a gas of the highest and most uniform purity, is supplied in readily portable cylinders, particularly well adapted for use in and about mines.

Thanks to the quality of Prest-O-Lite Dissolved Acetylene and the portability of the Prest-O-Lite Cylinder, there is no job of welding or cutting too difficult nor too inaccessible.

Forty plants and warehouses insure a steady and plentiful supply of Prest-O-Lite.

THE PREST-O-LITE COMPANY, Inc.
General Offices: Carbide and Carbon Building, 30 East 42nd St., New York
Balfour Building San Francisco
In Canada: Prest-O-Lite Co. of Canada, Limited, Toronto

PW-511-21

BUYER'S DIRECTORY

ACID, SULPHURIC
Irvington Smelting & Refining Works, Irvington, N. J.

AERIAL TRAMWAYS
American Steel & Wire Co., Chicago and New York.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

AMALGAMATORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mine Equipment & Supply Co., Denver, Colo.

ARMATURES
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ASBESTOS PRODUCTS
Mikesell Bros. Co., 156 North La Salle St., Chicago, Ill.

ASSAYERS
Walter E. Burlingame, 1736 Lawrence St., Denver, Colo.
Indiana Laboratories Co., Hammond, Ind.
Ledoux & Co., Inc., 99 John St., New York.
Pennsylvania Smelting Co., Pittsburgh, Pa.
Union Assay Office, Inc., Box 1446, Salt Lake City, Utah.

AUTOMATIC CAR CAGERS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

AUTOMATIC COAL SKIP
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

AUTOMATIC (Mine Doors, Truck and Electric Switches)
American Mine Door Co., Canton, Ohio.

BALL MILLS
Mine Equipment & Supply Co., Denver, Colo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

BATTERY-CHARGING EQUIPMENT
General Electric Co., Schenectady, N. Y.

BELTING (Conveyor, Elevator, Transmission)
Jeffery Mfg. Co., 958 N. Fourth Avenue, Columbus, Ohio.

BELTING, SILENT CHAIN
Morse Chain Co., Ithaca, N. Y.

BINS (Coke and Coal)
Jeffrey Mfg. Co., Columbus, Ohio.

BIT SHARPENERS
Denver Rock Drill Mfg. Co., Denver, Colo.

BLASTING SUPPLIES
Atlas Powder Company, Wilmington, Del.
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
National Fuse & Powder Co., Denver, Colo.

BLOWERS
General Electric Co., Schenectady, N. Y.

BOILERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis. (feed pump).
Mine Equipment & Supply Co., Denver, Colo.

BOXES, JOURNAL
J. R. Fleming & Son Co., Inc., Scranton, Penna.

BRATTICE CLOTH
Mikesell Brothers Co., 156 N. La Salle Street, Chicago, Ill.

BREAKERS (Construction and Machinery)
Jeffrey Mfg. Co., Columbus, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilmot Engineering Co., Hazleton, Pa.

BRIQUETTING MACH.
Jeffrey Mfg. Co., Columbus, Ohio.

BUCKETS (Elevator)
Hendrick Manufacturing Company, Carbondale, Penna.
Jeffrey Mfg. Co., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CABLES (Connectors and Guides)
American Mine Door Co., Canton, Ohio.

CABLEWAYS
Jeffrey Mfg. Co., Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

CAGES
Car-Dumper & Equipment Co., Chicago, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Holmes & Bros., Robert, Inc., Danville, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

CAGE (Safety Appliances)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAR CONTROL AND CAGE EQUIPMENT
Car-Dumper & Equipment Co., Chicago, Ill.

CAR DUMPS
Car-Dumper & Equipment Co., Chicago, Ill.

CAR AND CAR WHEELS
Hockensmith Mine Car Co., Penn Station, Pa.
United Iron Works Co., Kansas City, Mo.
Watt Mining Car Wheel Co., Barnesville, Ohio.

CAR-HAULS
Car-Dumper & Equipment Co., Chicago, Ill.

CASTINGS
Jeffrey Mfg. Co., 958 N. Fourth Street, Columbus, Ohio.
The Lunkenheimer Co., Cincinnati, Ohio.
Mine Equipment & Supply Co., Denver, Colo.

CHAINS
Jeffrey Mfg. Co., Columbus, Ohio.
Morse Chain Co., Ithaca, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CHEMICALS
The Barrett Company, 90 West St., New York City.
Roessler & Hasslacher Chemical Co., 709-717 Sixth Avenue, New York.

CHEMISTS
Walter E. Burlingame, 1736 Lawrence St., Denver, Colo.
Hunt, Robt., & Co., Insurance Exchange, Chicago, Ill.
Indiana Laboratories Co., Hammond, Ind.
Ledoux & Co., A. R., Inc., 99 John St., New York City.
Union Assay Office, Inc., Box 1446, Salt Lake City, Utah.

CIRCUIT BREAKERS
Automatic Reclosing Circuit Breaker Co., The, Columbus, O.
General Electric Co., Schenectady, N. Y.

CLAMPS (Trolley)
Ohio Brass Co., Mansfield, Ohio.

CLUTCHES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

COAL COMPANIES
Clinchfield Coal Corp., Dante, Va.
Lehigh Coal & Navigation Co., Philadelphia, Pa.
Stonega Coal & Coke Co., Philadelphia, Pa.
Thorne, Neale & Co., Philadelphia, Pa.
Wholesale Coal Co., Pittsburgh, Pa

COAL CRUSHERS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., Columbus, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.

COAL CUTTERS
Goodman Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio.

COAL DRYING PLANTS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

COAL HANDLING MACHINERY
Jeffrey Mfg. Co., Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Watt Mining Car Wheel Co., Barnesville, Ohio.

COAL LOADING MACHINES
Myers-Whaley Company, Knoxville, Tenn.

COAL MINING MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

COAL MINE POWER PLANTS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

COAL MINING PLANTS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

COAL WASHING MACHINERY
Stephens-Adamson Mfg. Co., Aurora, Ill.

COAL WASHING PLANTS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

COCKS (Locomotive, Cylinder and Gauge)
The Lunkenheimer Co., Cincinnati, Ohio.
Nicholson, W. H., & Co., Barre, Pa.

COILS (Choke)
General Electric Co., Schenectady, N. Y.

COMPRESSORS, AIR
General Electric Co., Schenectady, N. Y.

CONCENTRATORS (Magnetic)
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

CONCENTRATORS (Table)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mine Equipment & Supply Co., Denver, Colo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago and New York.

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

CONSULTING ENGINEERS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.
Shourds-Stoner Co., Inc., Terre Haute, Ind.

CONTRACTORS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

CONTROLLERS
General Electric Co., Schenectady, N. Y.
Goodman Manufacturing Co., Halsted St. and 48th Place, Chicago, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CONVEYORS, BELT
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS, CHAIN FLIGHT
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Wilmot Engineering Co., Hazleton, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS, COAL
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS AND ELEVATORS
Jeffrey Mfg. Co., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS, PAN OR APRON
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS, PANS AND FLIGHTS
Hendrick Manufacturing Company, Carbondale, Pa.

CONVEYORS, SCREW
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

COPPER ELECTROLYTIC
United Metals Selling Co., 42 Broadway, New York City.

COPPER WIRE
Anaconda Copper Mining Co., 111 W. Washington St., Chicago, Ill.

CORE DRILLING
H. R. Ameling Prospecting Co., St. Louis, Mo.
Hoffman Bros., Punxsutawney, Pa.

COUPLINGS
Nicholson, W. H., & Co., Wilkes-Barre, Pa.

CRUSHERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Mine Equipment & Supply Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.
United Iron Works Co., Kansas City, Mo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

CRUSHERS, COAL
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.
United Iron Works Co., Kansas City, Mo.

CRUSHING PLANTS, COKE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

CYANIDE
American Cyanamid Co., New York, N. Y.
Roessler and Hasslacher Chemical Company, 709 Sixth Avenue, New York City.

DERRICKS AND DERRICK FITTINGS
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.

DESIGNERS OF PLANTS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Mine Equipment & Supply Co., Denver, Colo.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

DIAMOND CORE DRILL CONTRACTING
Hoffman Bros., Punxsutawney, Pa.

DOORS, AUTOMATIC MINE
American Mine Door Co., Canton, Ohio

DRAG LINES
Denver Rock Drill Mfg. Co., Denver, Colo.

DREDGES, GOLD AND TIN
New York Engineering Co., 2 Rector St., New York City.

DRIFTERS, DRILL
Denver Rock Drill Mfg. Co., Denver, Colo.
Ingersoll-Rand Co., New York City.

DRILLS (Blast Hole)
Denver Rock Drill Mfg. Co., Denver, Colo.
Ingersoll-Rand Co., New York City.

DRILLS, CORE
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., New York City.

DRILLS, ELECTRIC
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York City.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Union Electric Co., Pittsburgh, Pa.

DRILLS, HAMMER
Denver Rock Drill Mfg. Co., Denver, Colo.
Ingersoll-Rand Co., New York City.

DRILLS (Hand Operated Coal)
Ohio Brass Co., Mansfield, Ohio.
Ingersoll-Rand Co., New York City.

DRILLS, PNEUMATIC
Denver Rock Drill Mfg. Co., Denver, Colo.
Ingersoll-Rand Co., New York City.

DRILLS, PROSPECTING
Hoffman Bros., Punxsutawney, Pa.
New York Engineering Co., 2 Rector St., New York City.

DRILLS, ROCK
Denver Rock Drill Mfg. Co., Denver, Colo.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York City.
Union Electric Co., Pittsburgh, Pa.

DRILL STEEL SHARPENERS
Denver Rock Drill Mfg. Co., Denver, Colo.

DRIVES, SILENT CHAIN
Morse Chain Co., Ithaca, N. Y.

DRUMS (Hoisting, Haulage)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DRYERS, ORE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DUMPERS, ROTARY
Car-Dumper & Equipment Co., Chicago, Ill.

DUMP CARS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DYNAMITE
du Pont Powder Co., The E. I. Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
National Fuse & Powder Co., Denver, Colo.

DYNAMOS
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ELECTRICAL APPARATUS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ELECTRIC HOISTING MACHINERY
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

ELECTRIC LOCOMOTIVES
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ELECTRIC MINE SUPPLIES
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

ELECTRICAL SUPPLIES
General Electric Co., Schenectady, N. Y.
Union Electric Co., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ELEVATORS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

ELEVATORS, BUCKET
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

ELEVATOR MACHINERY
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

ELIMINATORS
Nicholson, W. H. & Co. Wilkes-Barre, Pa.

ENGINES
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

ENGINES, GAS AND GASOLINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mine Equipment & Supply Co., Denver, Colo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

ENGINES (Hoisting and Hauling)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

ENGINES, OIL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mine Equipment & Supply Co., Denver, Colo.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

ENGINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

ENGINEERS
H. R. Ameling Prospecting Co., St. Louis, Mo.
Hunt, Robert & Co., Insurance Exchange, Chicago, Ill.
Indiana Laboratories Co., Hammond, Ind.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

EXPLOSIVES
Atlas Powder Co., Wilmington, Del.
Du Pont Powder Co., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
National Fuse & Powder Co., Denver, Colo.

FANS, VENTILATING
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
General Electric Co., Schenectady, N. Y.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec., & Mfg. Co., East Pittsburgh, Pa.

FEEDERS, ORE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.

FILTER CLOTH METALLIC
United Filters Corpn., 65 Broadway, New York City.

FILTERS, PRESSURE AND CONTINUOUS
United Filters Corpn., 65 Broadway, New York City.

FILTERS (Water)
Wm. B. Scaife & Sons Co., Oakmont, Pa.

FLOTATION OILS
The Barrett Co., 17 Battery Place, New York City.
General Naval Stores Co., 90 West St., New York City.

FLOW METERS
General Electric Co., Schenectady, N. Y.

FORGINGS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.
Mine Equipment & Supply Co., Denver, Colo.

FORGED STEEL BALLS
Mine Equipment & Supply Co., Denver, Colo.

FROGS AND SWITCHES
Central Frog & Switch Co., Cincinnati, Ohio.

FURNACES, MECHANICAL ROASTING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

GASKETS
Mikesell Bros. Co., 156 N. La Salle St., Chicago, Ill.

GEARS
General Electric Co., Schenectady, N. Y.
Jeffrey Mfg. Co., Columbus, Ohio.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

GEARS, SILENT CHAIN
Morse Chain Co., Ithaca, N. Y.

GENERAL SHEET AND LIGHT STRUCTURAL WORK
Hendrick Mfg. Co., Carbondale, Pa.

GENERATORS AND GENERATING SETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

GRINDING BALLS
Mine Equipment & Supply Co., Denver, Colo.

HANGERS (Insulated Trolley)
Ohio Brass Co., Mansfield, Ohio.

HANGERS (Sanitary Clothes)
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.

HEADLIGHTS, ARC AND INCANDESCENT
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

HOISTS, ELECTRIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

HOISTS, PORTABLE
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Stephens-Adamson Mfg. Co., Aurora, Ill.

HOISTS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
United Iron Works Co., Kansas City, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.

HOISTS (Room & Gathering)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Holmes, Robert & Bros., Inc., Danville, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

HOISTING ROPES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HYDRAULIC MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Car-Dumper & Equipment Co., Chicago, Ill.
Worthington Pump & Machinery Corp., 115 Broadway, New York City

INDUSTRIAL HOUSING
General Electric Co., Schenectady, N. Y.

INSTRUMENTS, ELECTRICAL
General Electric Co., Schenectady, N. Y.

INSULATING MATERIAL, ELECTRIC
General Electric Co., Schenectady, N. Y.
Mikesell Bros. Co., 156 N. La Salle St., Chicago, Ill.

INSULATING TAPE AND CLOTH
General Electric Co., Schenectady, N. Y.
Mikesell Bros. Co., 156 N. La Salle St., Chicago, Ill.

INSULATORS, FEEDER WIRE
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATORS, SECTION
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATORS (Porcelain)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATORS (Third Rail)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Trolley)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

INSULATED WIRE AND CABLE
American Steel & Wire Co., Chicago, Ill.
Roebling Sons, John A., Trenton, N. J.

JACKS
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.

JIGS
Mine Equipment & Supply Co., Denver, Colo.

JOURNAL BOXES
J. R. Fleming & Son Co., Inc., Scranton, Penna.

KILNS (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

KILNS (Rotary Ore Nodulizers)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LAMPS, ARC AND INCANDESCENT
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LAMPS (Carbon)
General Electric Co., Schenectady, N. Y.

LAMPS, ELECTRIC
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LEAD ORES
American, Zinc, Lead & Smelting Co., 1012 Pierce Bldg., St. Louis, Mo.

LIGHTNING ARRESTERS
General Electric Co., Schenectady, N. Y.

LOADING BOOMS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., Columbus, Ohio.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

LOADING MACHINES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Myers-Whaley Company, Knoxville, Tenn.

LOCOMOTIVE COALING STATIONS
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.

LOCOMOTIVES, ELECTRIC
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Ironton Engine Co., Ironton, Ohio.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Mancha Storage Battery Locomotive Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES, GASOLINE
Ironton Engine Co., Ironton, Ohio.
Mine Equipment & Supply Co., Denver, Colo.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Chicago, Ill.
Ironton Engine Co., Ironton, Ohio.

LOCOMOTIVES, STEAM
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES, STORAGE BATTERY
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Ironton Engine Co., Ironton, Ohio.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Mancha Storage Battery Locomotive Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MACHINERY, TRANSMISSION (Power)
Morse Chain Co., Ithaca, N. Y.

MICA
Mikesell Bros. Co., 156 N. La Salle St., Chicago, Ill.

MILLS, BALL
Mine Equipment & Supply Co., Denver, Colo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

MILLS, STAMP
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mine Equipment & Supply Co., Denver, Colo.

MINE CAR TRUCKS
J. R. Fleming & Son Co., Inc., Scranton, Penna.

MINE DOORS, AUTOMATIC
American Mine Door Co., Canton, Ohio.

MINING MACHINES
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.

MINING MACHINES CHAIN AND PUNCHER
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

MINING MACHINES (Electric)
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MINING MACHINERY
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.
Denver Rock Drill Mfg. Co., Denver, Colo.
Mine Equipment & Supply Co., Denver, Colo.

MINE CAR HITCHINGS
Hockensmith Wheel & Mine Car Co., Penn Station, Pa.

MINE CAR TRUCKS
Hockensmith Wheel & Mine Car Co., Penn Station, Pa.

MINE SIGNALS
American Mine Door Co., Canton, Ohio.

MINE SUPPLIES
Mine Equipment & Supply Co., Denver, Colo.

MINING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

MOTOR CONTROL APPARATUS
General Electric Co., Schenectady, N. Y.

MOTORS
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

NODULIZERS, ORE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

OILS, FLOTATION, CREOSOTE
The Barrett Company, New York City.

ORE, BUYERS AND SELLERS OF
Irvington Smelting & Refining Works, Irvington, N. J.
Phelps-Dodge Corporation, New York City.

ORE CRUSHERS
Mine Equipment & Supply Co., Denver, Colo.

ORE FEEDERS
Mine Equipment & Supply Co., Denver, Colo.

ORE SAMPLERS
Indiana Laboratories Co., Hammond, Ind.
Ledoux & Co., Inc., 99 John St. New York.

PERFORATED METALS
Chicago Perforating Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PERMISSIBLES, Explosives
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington Del.
National Fuse & Powder Co., Denver, Colo.

PICKING TABLES
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Roberts & Schaefer Co., McCormick Bldg., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

PIG LEAD
Pennsylvania Smelting Co., Pittsburgh, Penna.
United Metals Selling Co., 42 Broadway, New York City.

PIPE, CAST IRON
Hockensmith Mine Car Co., Penn Station, Pa.

PIPE COVERINGS
Mikesell Bros. Co., 156 N. La Salle St., Chicago, Ill.

PIPE (Wood)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

POWDER, BLASTING
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
National Fuse & Powder Co., Denver, Colo.

POWER SHOVELS
Myers-Whaley Company, Knoxville, Tenn.

POWER TRANSMISSION MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.

PRESSES
United Filters Corpn., 65 Broadway, New York City.

PROSPECTING DRILLS
Hoffman Bros., Punxsutawney, Pa.

PULVERIZERS, COAL AND COKE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

PUMPS, CENTRIFUGAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
United Iron Works Co., Kansas City, Mo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

PUMPS, MILL
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

PUMPS, MINE
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
United Iron Works, Kansas City, Mo.
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

PUMPS (Electric)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS (Gathering or Dip)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS, POWER
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
General Electric Co., Schenectady, N. Y.

PUMPS, STEAM
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

PUMPS, VACUUM
Worthington Pump & Machinery Corp., 115 Broadway, New York City.

RAIL BONDS
American Steel & Wire Co., Chicago and New York.
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

RAILWAY SUPPLIES
James H. Channon Mfg. Co., 227 W. Erie St., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

ROCK CRUSHERS
Mine Equipment & Supply Co., Denver, Colo.

ROCK DRILLS
Denver Rock Drill Mfg. Co., Denver, Colo.
General Electric Co., Schenectady, N. Y.

RODS, COPPER, HOT ROLLED
Anaconda Copper Mining Co., Rolling Mills Dept., 111 W. Washington St., Chicago, Ill.

ROLLING MILL MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

ROPE, TRANSMISSION
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

ROPE, WIRE
American Steel & Wire Co., Chicago and New York.
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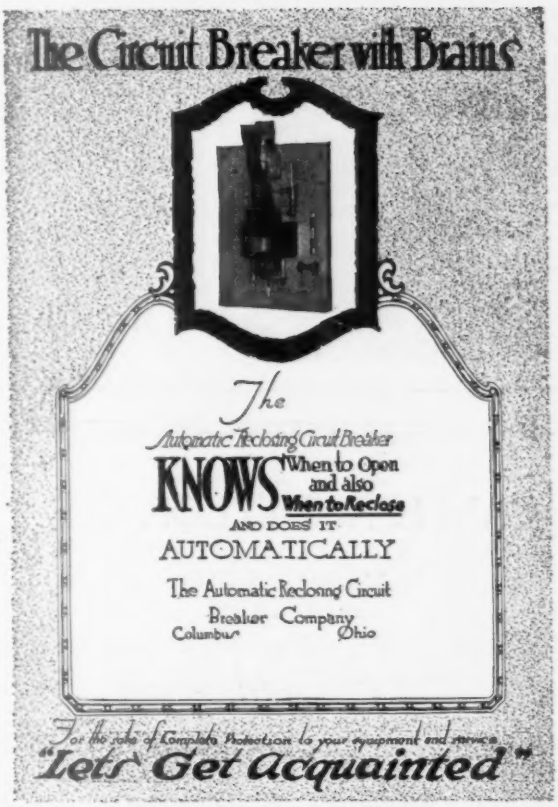

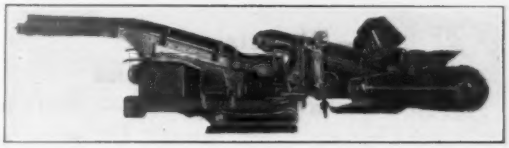

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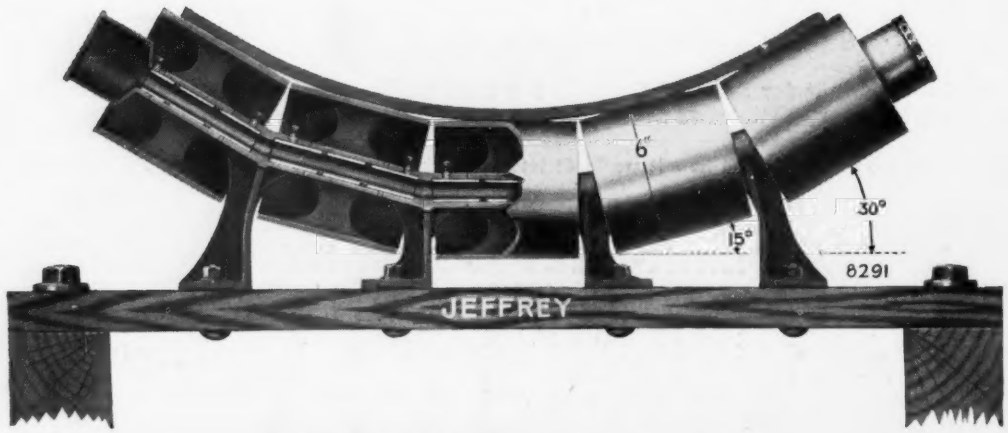

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